January-March 2007

Number 1060
Volume 132

The Naturalist

A QUARTERLY JOURNAL OF NATURAL HISTORY FOR THE NORTH OF ENGLAND

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Published by the Yorkshire Naturalists' Union

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THE HAZEL DORMOUSE (*MUSCARDINUS AVELLANARIUS*): RE-INTRODUCTION TO NORTH YORKSHIRE

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Background

The common (hazel) dormouse, *Muscardinus avellanarius* (L.), is a species whose range in Britain has contracted markedly over the past century (Bright & Morris, 2005). Howes (1985) summarized the records for Yorkshire and noted that most came from the 19th and early 20th centuries although a few were more recent with a number of sightings from the 1950s and 1960s. The latest claims mentioned by Howes came from the Esk Valley where remains were apparently found in an owl pellet and an animal sighted in 1979, and from near Kirkbymoorside where a hibernating individual was discovered in January 1980. It is not clear to what extent these important records were verified by other mammalogists.

The current British distribution of the dormouse was determined by the results of the Great Nut Hunt of 1993, organized by Pat Morris and Paul Bright, and supported by English Nature. The hunt, for characteristically opened hazelnuts, indicated healthy populations in the southern counties, Wales and the Welsh Marches but the species was, with a few notable exceptions, apparently absent from central, eastern and northern England. However, pre-1900, dormice were found throughout England, even as far north as the Glasgow area (Yalden, 1999: 121). In 1997, a Victorian Nut Hunt, funded by the People's Trust for Endangered Species and English Nature, was organized by Paul Bright. This survey, using the same techniques as before, focused specifically on woods in northern England in which the species was recorded by Victorian naturalists. No evidence was found to indicate that dormouse populations still exist in Yorkshire.

The reasons for the general decline in dormouse fortunes are complex but it is thought that habitat fragmentation might be one important factor (Bright & Morris, 1996; Bright *et al*., 2006). If the population in a particular wood goes extinct for whatever reason, it can only be restored by the migration of animals from neighbouring colonies. If these are few and far between, and if there are no suitable corridors for potential migrants to use, re-colonisation is unlikely, and populations are extinguished one by one. This can leave highly suitable sites without dormouse populations.

The dormouse is a priority species in the UK Biodiversity Action Plan (UKBAP) – for its full legal status see Bright *et al*. (2006: 53). It is also the subject of an individual Species Action Plan, a principal aim of which is to reintroduce animals to counties from which the species had been lost, and to boost numbers in counties where remnant populations are few and far between. Over the first five years of the Plan, dormouse re-introduction schemes were initiated at sites in six counties all, with the exception of Cheshire, located in the southern half of England. In 1998 a highly favourable site was identified near Helmsley, and in 1999 Yorkshire's first dormouse re-introduction programme became a reality (Oxford, 1999).

Re-introduction to Yorkshire

On 27 June 1999, cages and nestboxes for a soft-release programme were delivered to the site (Oxford, 1999). Two students, Jenny Armstrong and Carl Whitehead, set out 152 nestboxes in a grid covering the release area and 12 release cages were spaced out over the site to avoid conflicts between males. The animals were introduced to their new quarters on 1 July. In total 27 captive-bred animals were released, eight males and 19 females, from four captive-bred populations (Devon, Burnham Beeches, London Zoo and Whipsnade Wild Animal Park). The large, mesh cages were attached to hazel coppice and contained a wooden nest box, a water bottle and a squirrel-proof food delivery system. After 10 days a small hole was cut in the top of each release cage next to a tree trunk to allow the dormice

to come and go as they pleased. During July and August the frequency of feeds and the amount supplied were both gradually reduced to encourage the dormice to forage for themselves. Once the release cages were no longer used by the dormice they were removed from the site. Subsequent monitoring involved inspecting the boxes (eventually reduced to 142) for nests and animals on a monthly basis between May and October. When dormice were found their sex, weight, breeding condition, and whether they were active or torpid, was recorded.

POPULATION STATISTICS

Oxford (2003) reported the first analysis of these data and the complete results to date (1999 to 2006) are considered below. The production of litters (n = 17) through the year in the Helmsley population is shown in Figure 1. There is clearly a single peak of reproduction in August and September, gradually declining into October. Corbet and Harris (1991) mention young being found in Britain between May and September, exceptionally October. The occurrence of three nests in October, and this far north, may reflect the trend towards warmer autumns. The distribution of the number of young per litter is given in Figure 2 for all cases (n = 16) when full counts were made. The mean litter size is 5.0 (median = 5). The median litter sizes quoted in Corbet and Harris (1991) for Britain is 4 (max. 9) and means for Germany and Czechoslovakia 3.7 and 4.7, respectively. Juškaitis (1997) gives an annual mean litter size for a Lithuanian population of 3.9 (range 1 to 7) although the mean depends to some extent on female age, with older animals producing larger litters. The mean litter size for dormice in the Helmsley population is therefore very similar to, if not a little higher than, these other estimates.

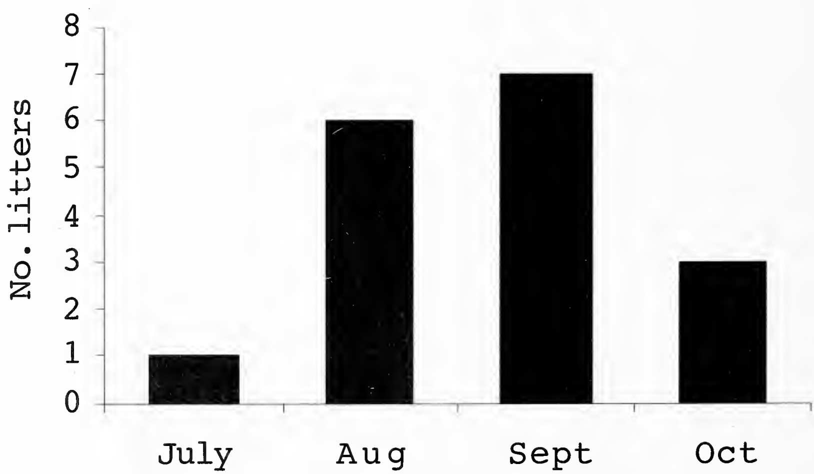

FIGURE 1.
Distribution of breeding by month. n = 17.

The sex ratio over all years and for all ages of animals in North Yorkshire is 70 males to 72 females, obviously very close to equality. Since our dormice are not marked in any way, these figures will inevitably include multiple counts of the same individual. Nevertheless, the ratio is valid if one assumes individual males and females are equally likely to be caught more than once. Corbet and Harris (1991) report that males predominate in nest

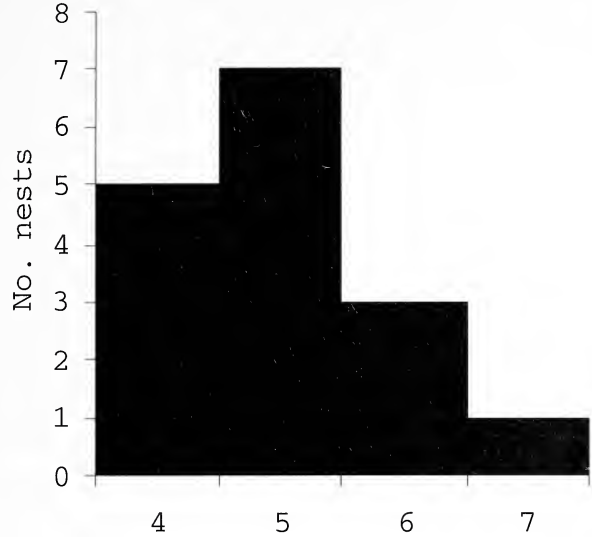

FIGURE 2.
Distribution of litter sizes. n = 16.

boxes and among live-trapped adults (ratio 1.4 : 1) but in his demographic study of dormice in Lithuania, Juškaitis (1999) found a nest-box sex ratio very close to 1 : 1.

The spatial distributions of dormice, nests and litters from 1999 to 2004 have been analysed elsewhere (Oxford, 2004). As the dormice are not marked, tracking the movements of individuals is impossible. The general trend is for boxes towards the periphery of the wood to become less well used with time, but otherwise no obvious patterns emerge.

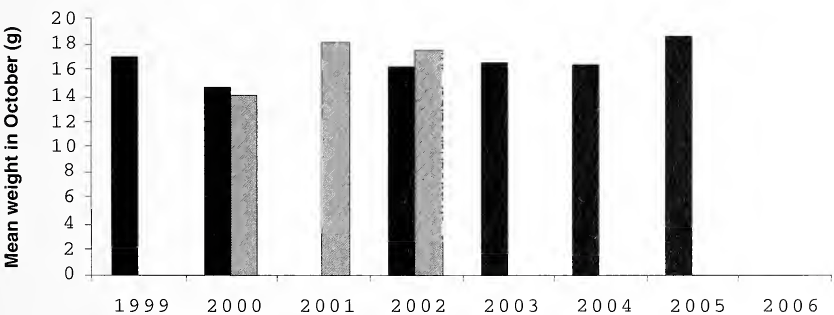

FIGURE 3.
Mean weight for dormice over seven grams in October of each survey year for the Helmsley population (black) and for 10 random populations taken from *The Dormouse Monitor* (grey) – see text.

Population trends in dormice are monitored in Britain by an index calculated as the mean number of animals, per 50 nest boxes, that weigh seven grams or more in the October census. Mice lighter than this are considered unlikely to overwinter successfully. The black columns in Figure 3 show the mean weight for mice weighing more than seven grams for the period 1999-2006 in the Helmsley population. Foot-and-mouth disease restrictions prevented access to the wood during 2001 except in October when mice were counted but not weighed. The values shown in grey are from 10 populations randomly chosen from those monitored elsewhere in the country, as published in the newsletter of the National Dormouse Monitoring Programme, *The Dormouse Monitor*. As far as comparisons can be made, the Helmsley population does not, in this respect, appear to be out of line. The mean weights of mice across the years has fluctuated rather little, which is perhaps surprising given the variable population size index (Fig. 4) and thus the sample size upon which the mean weight is based.

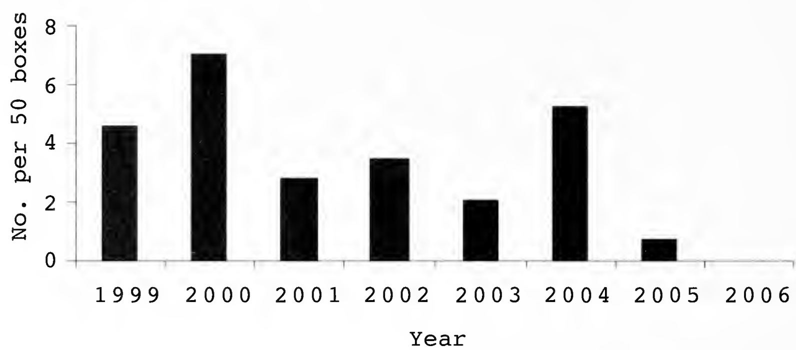

FIGURE 4.
Mean number of dormice, per 50 nest boxes, weighing seven grams or more in the October census.

In the Helmsley population, 2001 yielded only half the number of animals compared to 2000, a drop echoed at many of the sites reported in *The Dormouse Monitor.* This suggests a general climatic influence and illustrates just how sensitive dormouse populations are to adverse weather patterns (Bright & Morris, 2005). The index in subsequent years has risen and fallen but after a relative high in 2004 fell to 0.7 in 2005 and to zero in 2006. However, four new nests were constructed between the September and October box checks, showing that dormice were still in the vicinity although the last animal to be seen was recorded in mid-July. It must be remembered that nest boxes are used by an unknown fraction of dormice living in an area and that, as indicated above, a lack of animals detected in boxes does not mean the species is absent. However, it seems unlikely that the number of natural sites suitable for dormice to nest in has increased substantially in the wood over the last few years and so the implication is that the population size in 2006 is probably the smallest it has been since the release in 1999. Many factors mean that the national dormouse population size index should be treated with caution. Chance will play a major part in determining the precise number of animals recorded in October each year. It is also the case that the autumn of 2006 was remarkably mild and mice might be more likely to 'camp out' under these conditions and not be found in boxes. Nevertheless, this index is the best indication we have of how a population is faring and on this basis the Helmsley re-introduction, at least in the short term, seems not to be heading in the desired direction. Despite this, statistics on timing of breeding, size of litters and average weights of animals in October, as outlined above, do not suggest marked deviations from the national picture.

Dormice in the North

It is interesting to note that dormice in the most northerly remnant population, in Staward Wood SSSI, near Hexham, Northumberland have also been elusive over the last few years. Here boxes are checked monthly from April through to October. During 2004 and 2005 no mice or nests were found in 80 and 110 boxes, respectively. Another zero count looked likely for 2006 but in October an 18 g female was discovered (110 boxes checked) (Scott Dixon, personal communication). The second Yorkshire re-introduction, at West Tanfield in 2004, has also returned counts in single-figures after a high of 61 animals in September of the release year (Beer, 2004, 2005, 2006). The experience in Northumberland suggests that continued monitoring is required for a number of years before it can be concluded that the population is extinct.

It may always have been the case that dormouse populations in the north have struggled. An analysis of data from the National Dormouse Monitoring Programme by Sanderson (2002) has shown that abundance in populations situated in marginal northern and western Britain declined by 45% over the seven year period 1993 to 2000, and that dormouse densities at these sites were very low (0.47 per hectare) compared with between 3 and 5 per hectare nationally. This trend seems to have continued (Bright *et al.*, 2006). Swan (2004) undertook a radio-tracking study of the home ranges of dormice in three remnant northern sites (two in Cumbria, one in Northumberland) and two in the dormouse heartland in the south (Somerset and Herefordshire). He found that the home range of northern dormice was over twice that in the south (0.91 ha *vs.* 0.39 ha, respectively) and that the total distance travelled each night was significantly greater in the north (200 m *vs.* 149 m, respectively). Finally he discovered that the maximum distance moved away from the nest during foraging was significantly further in the north than in the south (74 m *vs.* 57 m, respectively). He concluded that the increased mobility of northern dormice could be explained by greater isolation of food resources and/or lower food quality. Indeed, the minimum number of trees visited per night in the north was greater than in the south, which supports the lower food-quality hypothesis.

The Future of Dormice in Yorkshire

Threats to dormouse populations, whether introduced or otherwise, include the continuing fragmentation of their habitats, loss of traditional coppice management and global climate change (Bright & Morris, 1996; Bright *et al.*, 2006). Climate change may affect dormice in several ways. Warmer winters with more variable temperature regimes are not beneficial for mammals that hibernate. Under these conditions they may be forced to wake from hibernation more frequently and thus waste valuable energy at a time of year when food is not available. Poor weather in late summer can affect breeding success, which is crucial especially for small populations. Finally, the dormouse relies on a sequence of flowers and fruits throughout its active months (Bright & Morris, 2005; Bright *et al.*, 2006). The timing of these is critical if there is to be no hiatus between one source of food disappearing and another taking its place. Climate change may well alter the relative phenologies of such food sources (e.g. Fitter & Fitter, 2002) and thus open temporal gaps during which suitable food is simply not available. These effects are likely to be especially important in northern populations.

In conclusion, although the dormouse is now re-established near Helmsley, and more recently at West Tanfield, its future is not assured. Only continued monitoring will indicate whether the long-term trajectory of these populations is in a positive or negative direction.

Acknowledgements: Many thanks to my colleagues Derek Heaton, Gordon Woodroffe and Michael Thompson for helping to monitor the Helmsley re-introduction, and to Scott Dixon and Amy-Jane Beer for information, respectively, on the Staward Wood and West Tanfield dormouse populations. Ann Hanson, Robert Masheder and Roma Oxford provided additional support in the field. Gordon Woodroffe and Roma Oxford kindly commented on earlier versions of the paper. Some of the material reproduced here has been taken, with the

permission of the editors, from annual reports on the Helmsley population published in the Yorkshire Mammal Group's journal, *Imprint*.

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BOOK REVIEW

Glencoe Caldera Volcano, Scotland by **B.P. Kokelaar** and **I.D. Moore**, with contributions from **T. Bradwell** and **D. Stephenson**. Available from: British Geological Survey, Keyworth, Nottingham NG12 5GG. £15.00 book, £12.00 map.

The many visitors to Glencoe come to admire, photograph and perhaps learn about the turbulent and violent social history of this romantic valley. However, few realise that the record of the rocks also reveals an equally violent and turbulent geological history which is some 420 million years old.

This book sets out to unravel the complex geological history of this world famous caldera volcano and to make it accessible to all, by providing an easily readable and profusely illustrated publication. One of its major assets is the careful way in which each aspect of the complex is explained in detail and supplemented with colour maps, sections, reconstructions and diagrams on almost every page. The annotated colour views are particularly useful in understanding the scenery, as are the key localities, which are linked to the map. The final chapter explains the development of the present landscape during and after the last glaciation.

I recommend this publication to professional and amateur alike as an excellent, modern interpretation of this ancient and very important geological feature.

PA

A HISTORY OF THE GREY SQUIRREL (*SCIURUS CAROLINENSIS*) INVASION OF CUMBRIA

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ABSTRACT

The American grey squirrel (*Sciurus carolinensis*) has been progressively replacing the native red squirrel (*Sciurus vulgaris*) in Britain ever since its introduction in 1876. Relict populations of the red squirrel are still extant in Wales, East Anglia and on some islands (Isle of Wight and islands in Poole Harbour). However, the largest concentrations of red squirrels in England are now confined to the north of England (Durham, Northumberland, Cumbria and west Lancashire), the northern most being contiguous with the Scottish populations in Berwick, Roxburgh and Dumfries.

The first grey squirrel to be recorded in Cumbria (Shorten, 1953) was trapped near Brough (NY7914) in 1944, and only occasional sightings and kills were recorded during the next 40 years. By 1984, however, there were reports of grey squirrels from many parts of Cumbria, most of them from the South Lakes.

In 1987, the Westmorland Grey Squirrel Control Society (WGSCS) was formed to monitor the spread, and to try and control the numbers of grey squirrels spreading into the county from North Lancashire. In November 1993, this was superseded by NPI Red Alert North West, with a far wider remit to conserve the red squirrel throughout its range in Cumbria and Lancashire. As information was limited, members of WGSCS collected records of grey squirrels culled, and distribution data for both species for that year as a datum line. The areas of both coniferous and deciduous woodland in each of the 10 km grid squares of Cumbria and surrounding areas of North Lancashire, West Yorkshire and Dumfries were calculated from data available from the Countryside Information System (CIS) (Howard & Bunce, 1996); this included data interpreted from satellite imagery. Grey squirrels were controlled in only in 13 of the 30 grid squares forming the boundary between Cumbria, West Yorkshire and North Lancashire. On the basis of this level of culling, it was calculated that only c.13% of the annual increment was being accounted for in the whole of this south eastern area, leaving >8000 juveniles as potential colonists each year.

INTRODUCTION

From the Proceedings of the Scottish Natural Heritage Conference on Red Squirrel Conservation in Scotland held in Edinburgh on 27 February 2006 and subsequent questions raised in the House of Lords (*Hansard*, 23 March 2006), it appears that many of the facts relating to the spread of the American grey squirrel (*Sciurus carolinensis*) are either unknown or incorrect. Similar mistakes have appeared in ESI (European Squirrel Initiative) *News Letters* (2006). In this paper we have therefore tried to produce a factual account covering the history of the grey squirrel in Cumbria during the period 1944-1993.

The grey squirrel was first introduced into England in 1876; thereafter, further importations continued until 1929, and stocks were released at more than 20 different sites in England and Wales (including the London Zoo in Regent's Park), three in Scotland and one in Ireland. The principal sites at which these squirrels were released and their initial spread there have been described by Middleton (1930, 1931, 1932, 1935). Some of these squirrels were imported from the USA, e.g. the Woburn (Bedfordshire) introduction, and others from Canada, e.g. the Loch Long (Argyll) introduction; both releases were effected in 1890 (Ritchie, 1920; Shorten, 1951). The nearest points of release to Cumbria were those in Swaledale near Northallerton in Yorkshire and near Fleetwood in Lancashire (Middleton, 1932).

The first records of grey squirrels in Cumbria were reported by Shorten (1953), all four of them in the old county of Westmorland. The first was trapped in 1944 just south of Brough (NY7914); the second was shot in 1947 just to the east of Kendal (SD5393); a third was trapped on the Veteripont estate (NY7221) in Murton Parish in 1949; the fourth was shot at Brough in 1950 (Shorten 1953).

During the next thirty years there were only isolated and infrequent reports of grey squirrels in the county: one seen in Levens Park (SD5085) in 1964, one drowned in Lake Windermere (SD3895) in 1975, one shot near Bassenthwaite (NY1732) in 1976, and one seen near Grassmere (NY3406) in 1977.

By 1984, however, reports of grey squirrels in many parts of the South Lakes and adjacent areas of North Lancashire began to circulate. In 1987 therefore, it was decided to set up an organization both to monitor the spread and control the numbers of grey squirrels in the county. This became known as the Westmorland Grey Squirrel Control Society (WGSCS), and included representatives from the Forestry Commission, National Trust, English Nature, Local Authorities, Wildlife Trusts, land and woodland owners/managers, local societies, and various conservation bodies with interests in the county (Lowe, 1993).

When NPI Red Alert North West (the red squirrel conservation partnership) was launched on 15 November 1993, it had a far wider remit, to try and conserve the remaining stocks of red squirrels throughout Cumbria and Lancashire. However, the scale of the problem could not be assessed for lack of data; only distribution maps for the two species of squirrel were available at that time.

As control of grey squirrel numbers was thought to be the only possible means of conserving the red squirrel (*Sciurus vulgaris*) in Cumbria, we (1) provided distribution maps for both the red and grey squirrel in Cumbria and adjacent areas for 1993 as a datum line, (2) attempted to assess the minimum effort required to prevent the existing well-established grey squirrel populations from producing further increments of potential colonists, using squirrel cull data and the area of woodland in each of the 10 km grid squares in the south-east Cumbria/north Lancashire/west Yorkshire zone, (3) assessed the probable size of the population of red squirrels present in Cumbria at that time, (4) calculated the minimum size of the population of grey squirrels and their annual increment if the latter were to be allowed to replace the former, and (5) suggested some alternative initiatives.

Materials and Methods

Squirrel surveys

Data describing the location of red and grey squirrel sightings in Cumbria during 1993 were obtained largely from the public at country shows and from members of the WGSCS as described by Lowe (1993). However, better coverage was obtained than for previous surveys by making contact with individual farmers in underrepresented localities through the Regional Secretaries of the National Farmers Union (NFU). In total, 527 squirrel records were received, 351 of reds and 176 of greys. Although these data were largely chance sightings and not the results of an objective study, they nonetheless provide the only available information on the distribution of squirrels throughout the area (Figs. 1 & 2).

Grey squirrel cull data

More quantitative information was obtained through knowledge of grey squirrel culls. Data on culls in relation to woodland area were acquired through contacting all woodland owners and individuals engaged in vermin control in the South Lakes and north Lancashire. Whilst all contacts knew the year when the first grey squirrel was seen and most of those culling grey squirrels could provide records for the last five years, only a few had kept complete records of all their earlier culls and most could provide only approximate totals for the earlier years. The total area of woodland with squirrel-culling as part of the management plan on the estates in the south Cumbria/west Yorkshire/north Lancashire zone amounted to 1852 ha, and the known and approximate cull figures between 1970 and

December 1993, amounted to more than 7000 in 13 of the 30 10 km grid squares in this zone. Including the whole of Cumbria, a further 82 grey squirrels had been killed in just 10 of the 81 additional 10 km squares during the same period.

Woodland type and area

The grey squirrel, by contrast with the red squirrel, originated in a hardwood habitat, and reaches its highest densities in mixed deciduous woodlands with oak (*Quercus* spp), the dominant tree species (Tittensor, 1977; Gurnell & Pepper, 1988; Kenward *et al.*, Robertson, 1992; Kenward & Holm, 1993). It is therefore necessary to distinguish between areas of hardwood and softwood if one is to relate the squirrel cull data to their prime habitat. To this end, the areas of deciduous woodlands and coniferous plantations were obtained from each 10 km grid square using data available from the Countryside Information System (CIS) (Howard & Bunce, 1996); this included data interpreted from satellite imagery. These data had been obtained during the period, winter 1988-summer 1990, and were the most recent available. The areas of each type of woodland are underrepresented however, as the method fails to record new plantations <5 years old, and linear plantings of trees, hedges and shelter belts. Otherwise, all copses and coverts >1 ha were identified as conifer or deciduous, and mapped. As it did not include clearings or clear felled areas in plantations or woodlands, it was also by far the most accurate method available and the most appropriate for this purpose.

The total areas of tree cover in the 30 10 km grid squares forming the Cumbria/Yorkshire/Lancashire boundary (SD44 - 84 north to SD49 89 inclusive) using CIS data, amounted to 14031 ha of deciduous woodland and 3703 ha of conifers. The total area of woodland in the whole of Cumbria (92 10 km grid squares) amounted to 29483 ha of deciduous trees and 26913 ha of conifers. With these sets of data it was, first of all, possible to prepare better and more up-to-date distribution maps for each species. It was also possible for the first time to map the grey squirrel cull data, and thus highlight the areas with the most firmly established populations.

The total number of grey squirrels culled in the 30 10 km grid squares in the border zone in 1993 was 1443. Elsewhere, occasional grey squirrels were also being culled in the South Lakes and in parts of the north of the county, but in these areas they were either just becoming resident (in the former) or were new arrivals from Scotland (these extras amounted to 41 culled in 1993). Using data from these 30 10 km grid squares, the average ratio between the squirrel cull and area of deciduous woodland enabled us to calculate the mean annual increment of grey squirrels from these 14031 ha of deciduous woodlands, and therefore estimate the minimum effort required to prevent further colonists from spreading north into the Lakes. Grey squirrel production from the coniferous plantations (largely spruce and larch) was not calculated as the only figures available for their density or fecundity in this habitat refer to pine woods (*Pinus sylvestris* and *P. nigra*) in the south of England (Kenward *et al.*, 1994).

Results

Squirrel distribution in Cumbria and adjacent areas in 1993

Maps of the distribution of the two species of squirrel in Cumbria and north Lancashire for the years 1987-1990 (Lowe, 1993) indicated that the red squirrel was present throughout both Cumbria and the adjacent parishes in Lancashire. In this earlier survey however, there were areas from which no records were received, notably from areas to the east of Carlisle, Penrith and Kendal.

In 1993, with improved coverage, the survey data suggested that the red squirrel was still present throughout the county (Fig. 1), but that it had been replaced to a large extent by the grey squirrel in the south east, in north Lancashire and west Yorkshire (Fig. 2). It should also be noted that there were no confirmed reports of grey squirrels in the North Lakes during 1987-1990 (Lowe, 1993). Skelcher (1991) had one report (unconfirmed) of a grey squirrel seen near Workington (NY0330) in January 1990. By 1993, there were records of

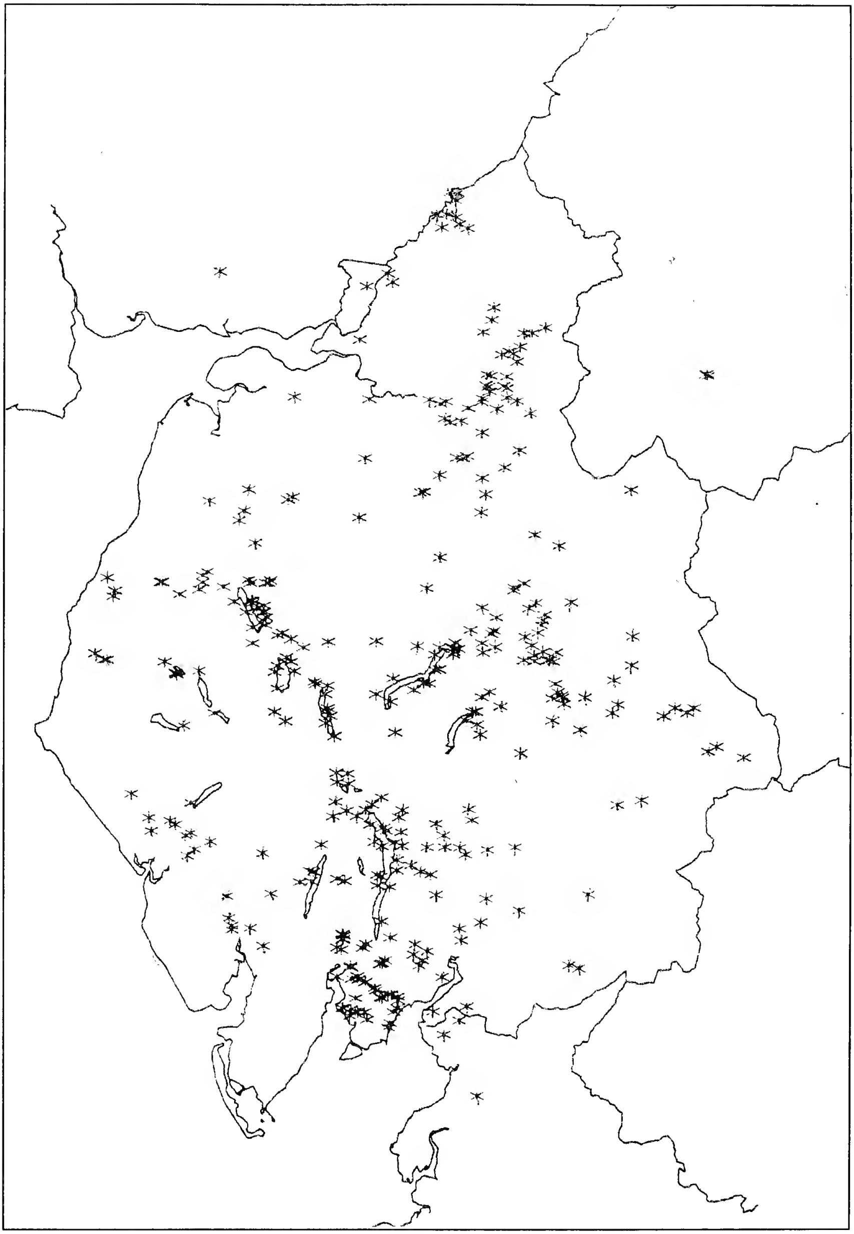

FIGURE 1.
Red squirrel distribution in Cumbria and adjacent areas in 1993.

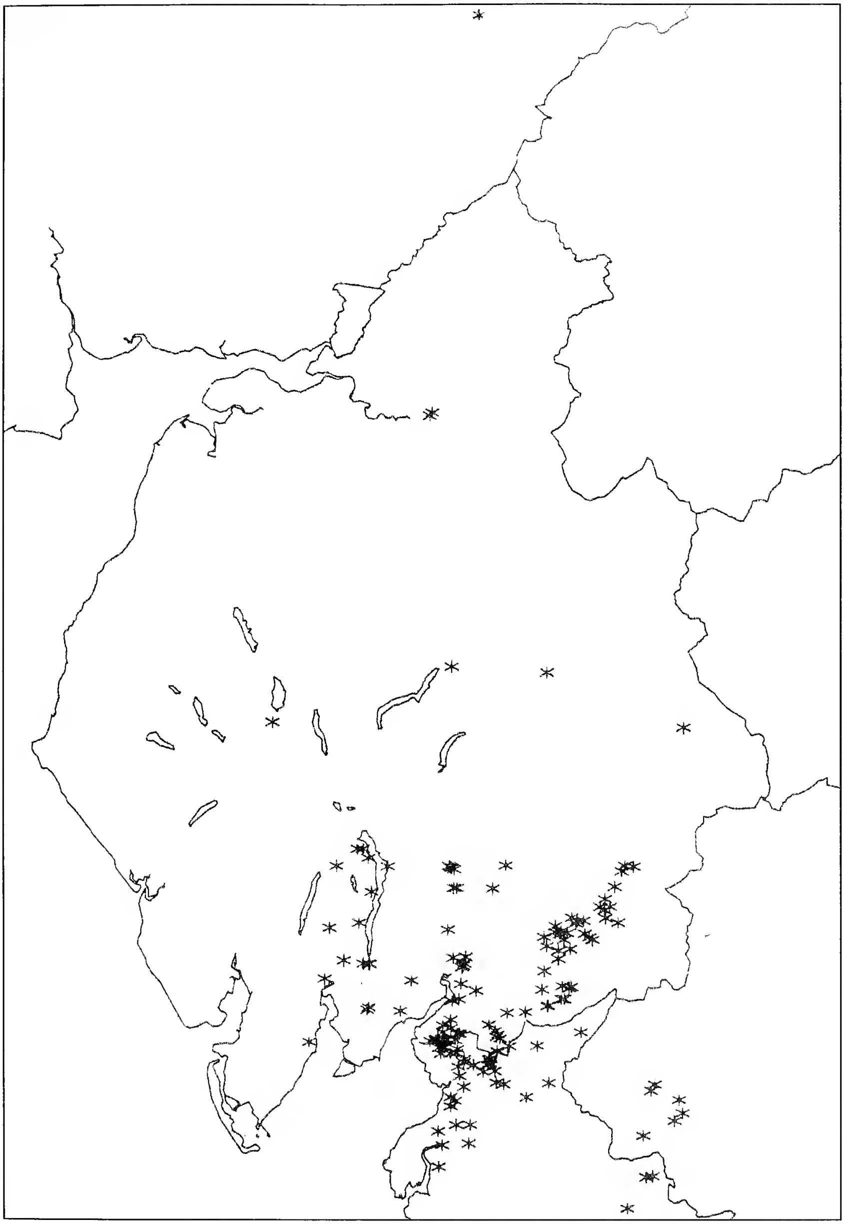

FIGURE 2.
Grey squirrel distribution in Cumbria and adjacent areas in 1993.

sightings or kills from 8 different 10 km squares in this northern area, the most northerly being just to the east of Carlisle (Fig. 2).

Probably none of these northern records represented the natural spread of the grey squirrel from the South Lakes (see Discussion). At that time an invasion from the north was expected as grey squirrels from Bowhill (NT4227) appeared to be moving south. One was recorded in 1994, just north of Newcastleton in the Liddle Valley (NT536083); another was seen (Dec 1994) near Canonbie (NY3976) <1km from the county boundary. Two were seen in Cumbria in 1995, one in March near Firbank (NY378647), and a second was found dead in July on the road near Sandy Syke (NY392658).

Grey squirrel abundance and culls

Only 17 of the 92 10 km grid squares of Cumbria were recorded as having had any culling of grey squirrels since 1970, and of these 6 were in the north of the county. However, as no more than two grey squirrels had been culled in any one of these 6 northern 10 km grid squares since 1990 (see Figs 3 & 4), there did not appear to be any significant concentration of grey squirrels in north Cumbria at that time. The 11 culled in NY30 were not included with those from north Cumbria as they were culled from a population in woods near Ambleside and were therefore south of the fells which divide the North from the South Lakes.

Of the 30 10 km squares constituting the south-eastern border zone, only in 13 was there any programme designed to control grey squirrel numbers. In three of these 10 km squares, the numbers culled since 1970 had topped 1000, but the sources of the grey squirrels colonizing the South Lakes were probably 10 km squares SD56, 57, 48 and SD68 (see Fig. 3). Little was known about the situation in those neighbouring squares where there was no culling, yet which had significant areas of woodland (see Table 1). The grey squirrels culled in these 30 10 km squares in 1993 are also shown in Table 1; where there is more than one figure for a 10 km grid square, it indicates that more than one estate was involved. The areas of woodland on estates undertaking squirrel control are shown in the adjacent column; if not known, the figure has been replaced by a question mark.

From Figure 4, it will be noted that whilst the earliest record since 1950 of a grey squirrel being culled (1968) appears in the 10 km square SD85 in north Lancashire, the next earliest record (1975) came from the South Lakes (SD39), and this was only one year earlier than the record from NY13 (1976) in the North Lakes. There was, therefore, no obvious trend in years to show either the rate or direction of spread of the grey squirrel in this region. On the other hand, the numbers culled in each 10 km square do suggest that the most firmly-established populations were in north Lancashire (SD64, 74, 56) and south east Cumbria (SD57, 48, 68) (see Fig. 3). These populations had probably built up over a considerable period of years before control measures were introduced because on some of these estates >100 were accounted for in the first year of culling. The apparent rate of increase indicated in Figure 5, is probably exaggerated because of this delay. At the same time, on many of the other estates where full records were kept, the pattern of increase in numbers is similar, with a slow start followed by an explosion of numbers some years later and with the cull suddenly doubling or even trebling that of the previous year.

Population densities of grey squirrels

Assuming the effort employed to cull grey squirrels was the same for each estate, the variation in apparent squirrel densities was high, culls ranging between 11.1 and 0.28 squirrels ha^{-1} of woodland (Table 1). There were, however, only two areas of woodland where culls exceeded 10 squirrels ha^{-1}. Both were small woodlands in natural corridors between larger areas of woodland; it is probable therefore that these squirrels were mainly migrants.

Omitting these two woodlands, only four of the remaining 14 estates had culls exceeding 1 squirrel ha^{-1}, and the mean, again assuming a constant culling effort on all estates, was 0.66 squirrels ha^{-1}. However, as most of these culls exceeded those of 1992,

TABLE 1.
Grey Squirrel cull and habitat data for the 30 10 km grid squares constituting the south-east Cumbria, west Yorkshire and north Lancashire border zone (1993).

10 km sq. O.S. Grid Ref	CIS area of hardwoods (ha)	CIS area of conifers (ha)	Grey squirrels culled	Area (ha) woodland + culling	Area (ha) Woodland – culling
SD 44	198	1			199
54	931	62			993
64	652	247	100	75	824
74	587	117	130	40	
			40	130	534
84	559	22			581
45	253	5			258
55	863	8			871
65	231	146			377
75	210	590	5	?	?
85	417	7	40	?	?
46	184	28			212
56	896	121	151	51	966
66	457	95			552
76	236	218	76	81	
			18	34	339
86	210	30			240
47	1347	8	102	364	
			4	8	983
57	610	78	50	40	
			51	90	
			10	1	557
67	355	16			371
77	35	3			38
87	76	345			421
48	1414	298	275	607	1105
58	510	120	49	?	?
68	395	110	170	240	
			48	54	
			12	28	183
78	129	243			372
88	136	504			640
49	1227	48	12	?	?
59	529	18			547
69	284	22	100	9	297
79	46	84			130
89	54	109			163
Total	14031	3703	1443	1852+	14028+

one cannot be certain that the squirrels had reached their population asymptote. Is it possible that (1) the culling effort was becoming more intensive?; the squirrel population had yet to reach a peak, (2) 1992 had produced an exceptional mast or seed crop, and thus enhanced breeding, and (3) there might even have been a migration of grey squirrels moving north from Lancashire? At times, grey squirrels were recorded migrating in large numbers; Seton (1928) estimated about 500 million grey squirrels emigrated from

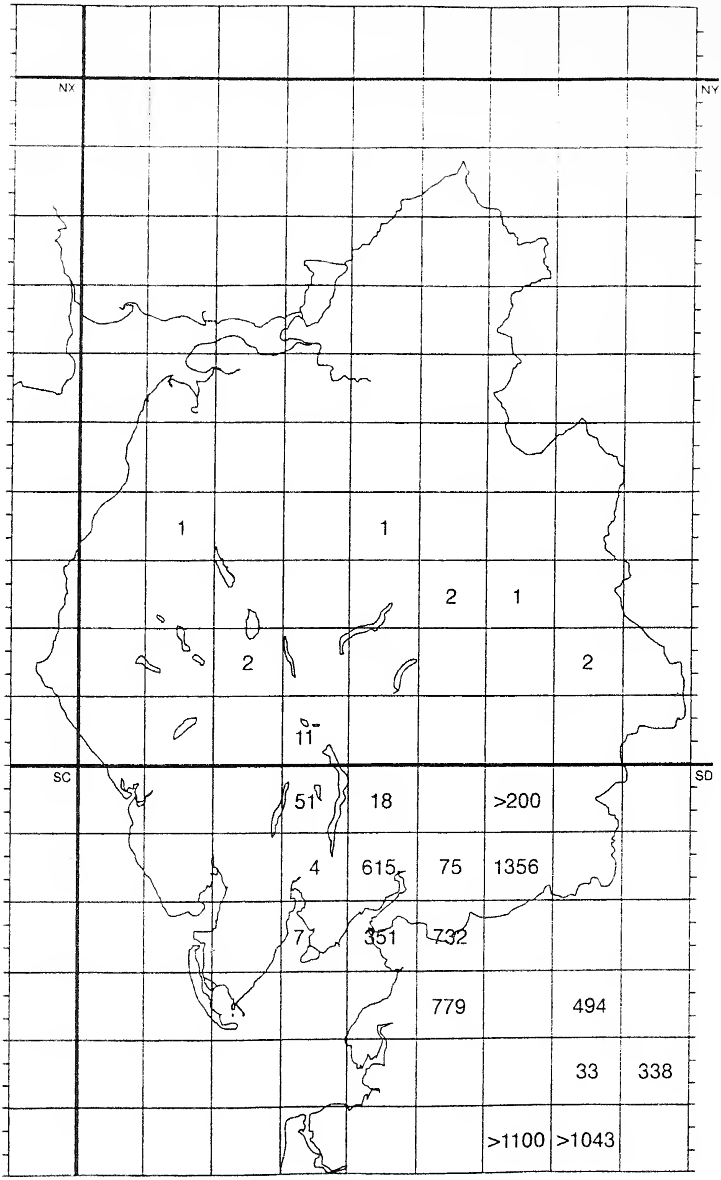

FIGURE 3.
Number of grey squirrels culled in each 10 km grid square, 1970-1993.

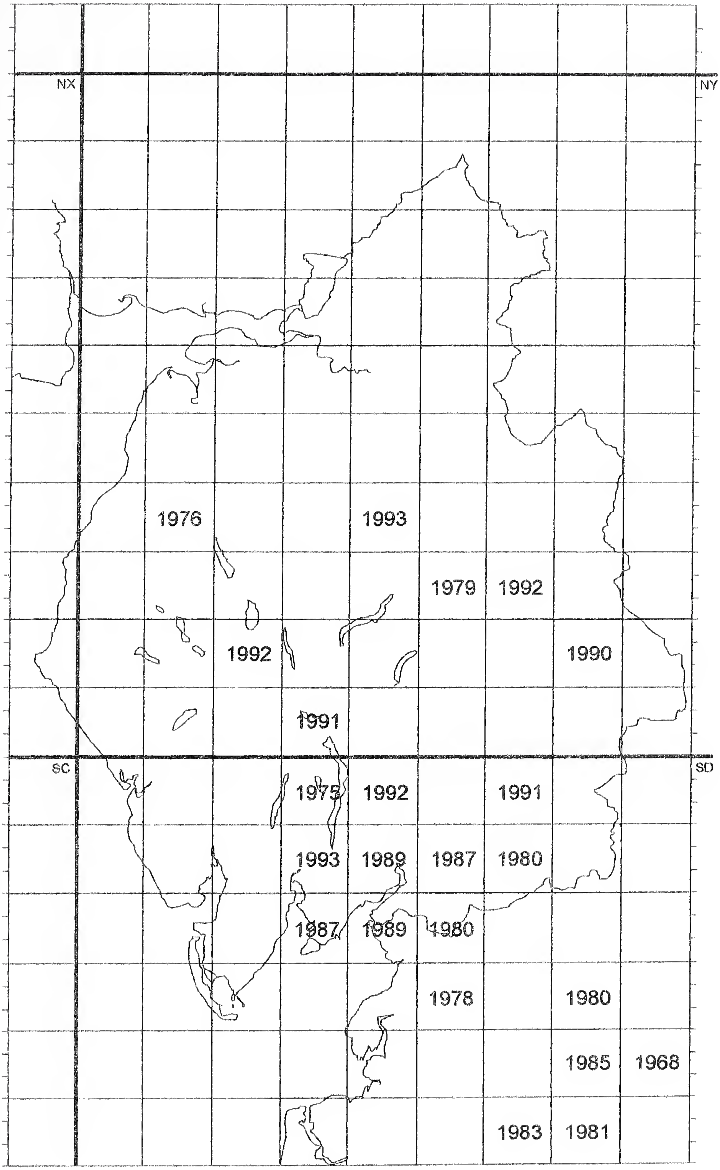

FIGURE 4.
The year in which the first grey squirrel was killed or found dead in each 10 km grid square.

Wisconsin in 1842 after a tree seed crop failure. Certainly, oak trees bore heavy crops of acorns in 1992, but the other possibilities could not be checked (see below). The one certainty is that the cull taken bore little relationship to the total population increment for these 30 10 km squares.

Assuming a minimum annual increment of 0.66 squirrels ha^{-1} (the total cull taken was 1227 squirrels on 1852 ha), this was, at best, only 13.2% of the possible cull from all the deciduous woodlands in these 30 squares (14031 ha).

Discussion

There are two questions that need to be answered concerning this invasion of north-west of England by the grey squirrel, if we are to ensure the survival of the red species:

1. Is it ecologically sensible to try to preserve the red squirrel in hardwood habitats when it evolved in, and is better adapted to, coniferous forests?
2. Is it possible to conserve the red squirrel in any part of its range where it has to compete for food with the grey squirrel?

The answer to the first question is undoubtedly No, for the following reasons. The grey squirrel, in contrast with the red squirrel, evolved in and is perfectly adapted to the hardwood habitats. Moreover, in Britain, the grey squirrel reaches population densities of 1-12 squirrels ha^{-1} (Southern, 1964), about 6 times higher than in the USA or Canada, where its normal density ranges between 0.75-1.85 squirrels ha^{-1} (MacClintock, 1970; Woods, 1980). The density of the red squirrel by contrast, rarely exceeds 1 squirrel ha^{-1} even in coniferous forests (Tittensor, 1977), and was 0.82 squirrels ha^{-1} in the only study of the red squirrel in deciduous woodland in the Lake District (Tonkin, 1983): a rather similar value to that for the grey squirrel in the New World.

The reason the grey squirrel reaches such high densities in Britain is probably because of the large size and nutritive value of the acorns on our native oak trees. The red squirrel is unable to digest this food, and will die if acorns are the only food source (Kenward & Holm, 1993); the latter therefore has to survive on a more limited diet. Despite these constraints, assuming a mean density of 0.8 squirrels ha^{-1} in both conifer and deciduous woodland and a total woodland area of 56396 ha in the 92 10 km squares comprising Cumbria, the red squirrel population can be calculated to have been in excess of 45000 in the 1970s.

In 1993, with grey squirrels well established in 8 of the 10 km grid squares in the south east of the county, the population was probably about 42000. However, with the grey squirrels consolidating their numbers in all areas in the south-east sector of Cumbria, it was expected that red squirrel numbers would be well below 40000 within the next few years. The situation has been exacerbated by the fact that the grey squirrel is a carrier of the parapoxvirus, which is lethal to the red squirrel. It needs therefore only one infected grey squirrel to contaminate all the drays and feeders used by the red squirrels for the local population of the latter to be wiped out.

Despite the publicity at the time of the launch of the red squirrel initiative, there were only 14 people attempting to stem the flow of grey squirrels from Lancashire and Yorkshire. This was equivalent to one person to every 21428 ha if homogeneously distributed. In practice, the situation was rendered even more difficult by the fact that there were many 10 km squares in which there was no control of grey squirrels at all (see Fig. 3). After 1993, the number of people trapping and shooting grey squirrels, and the numbers killed, was not monitored, so there are no figures to show whether the present level of culling is proving effective or not in any area of Cumbria. Moreover, although it is illegal to import, release or keep grey squirrels in captivity in Britain without a licence from the Ministry of Agriculture or Secretary of State for Scotland (Wildlife and Countryside Act 1981, amended by the Environmental Protection Act 1990), these regulations are not being observed. Injured grey squirrels are frequently rescued to be treated and released or kept in captivity, e.g. Batey, 1994; Rolf Harris, "Animal Hospital" TV programme in October 1995.

Moreover, grey squirrels have been, and are probably still being, transported and

released in many areas of the Lake District, e.g. at least two escaped from cages in Windermere (SD4098) in the 1970s; two were released in the car park at Holker (SD3676) in 1987; in 1993, two were released in Carlisle (NY3956) and two more in Penrith (NY5130). The four (two pairs) released in Keswick (NY2623) in the winter of 1992/93 were reputed to have been transported from a garden in Oxfordshire. These, together with the other introductions said to have taken place, probably explain the odd and apparently unrelated sightings and kills of grey squirrels in the North Lakes (see Fig. 2).

Therefore, while the public continues to encourage grey squirrels (feeding them in parks and gardens) and does not wish to see them controlled, there is little chance of survival for the red squirrel in mixed woodland, particularly where oak trees exceed 14% of the tree cover (Kenward *et al.*, 1992). This has been exacerbated by the fact that no one has any authority to request landowners, householders or Local Authorities to control grey squirrels on their property, unlike other pests listed in the same Act, e.g. rats (*Rattus norvegicus*) and rabbits (*Oryctolagus cuniculus*).

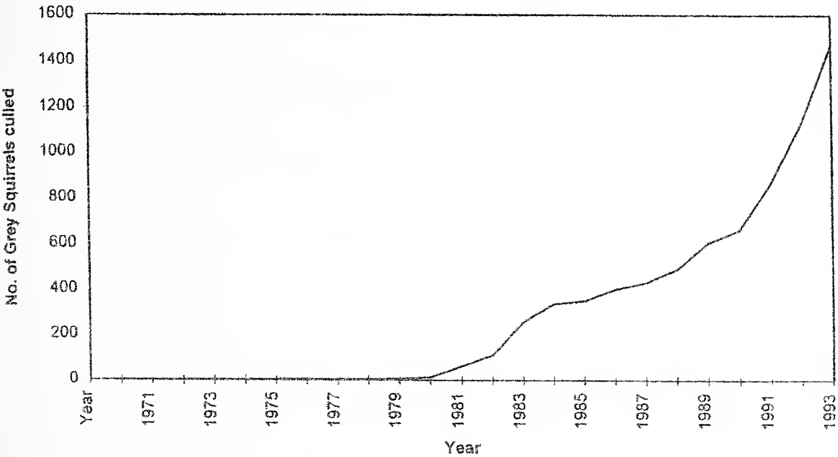

FIGURE 5.
The total numbers of grey squirrels culled in Cumbria and adjoining 10 km grid squares in Yorkshire and Lancashire during the period 1970-1993.

It is not possible to predict when the grey squirrel will have colonized all of Cumbria, because the colonizing process sometimes comes to a halt for no apparent reason, e.g. the grey squirrels recorded by Shorten (1953) in east Cumbria in the 1940s, have even after 50 years, yet to extend their range westwards. Another example was the extension eastwards by the grey squirrel from the Midlands, which failed to enter East Anglia for at least 18 years; even when introduced into the area, grey squirrels failed to become established (Matthews, 1952). By 1970 however, the grey squirrel had begun to colonize the area naturally, and had dispersed throughout East Anglia within the next two years.

On 9 February 1972, at a special meeting at Santon Downham, involving the Forestry Commission, Oxford University, The Nature Conservancy and local Naturalists Trusts, it was proposed that special measures should be taken to conserve the red squirrel in 2 reserves in Thetford. The objectives were almost identical with those drafted by NPI Red Alert North West, even including the order of priorities: the control of grey squirrels again being last on the list.

In Thetford, grey squirrel control measures were not introduced before 1972, and by

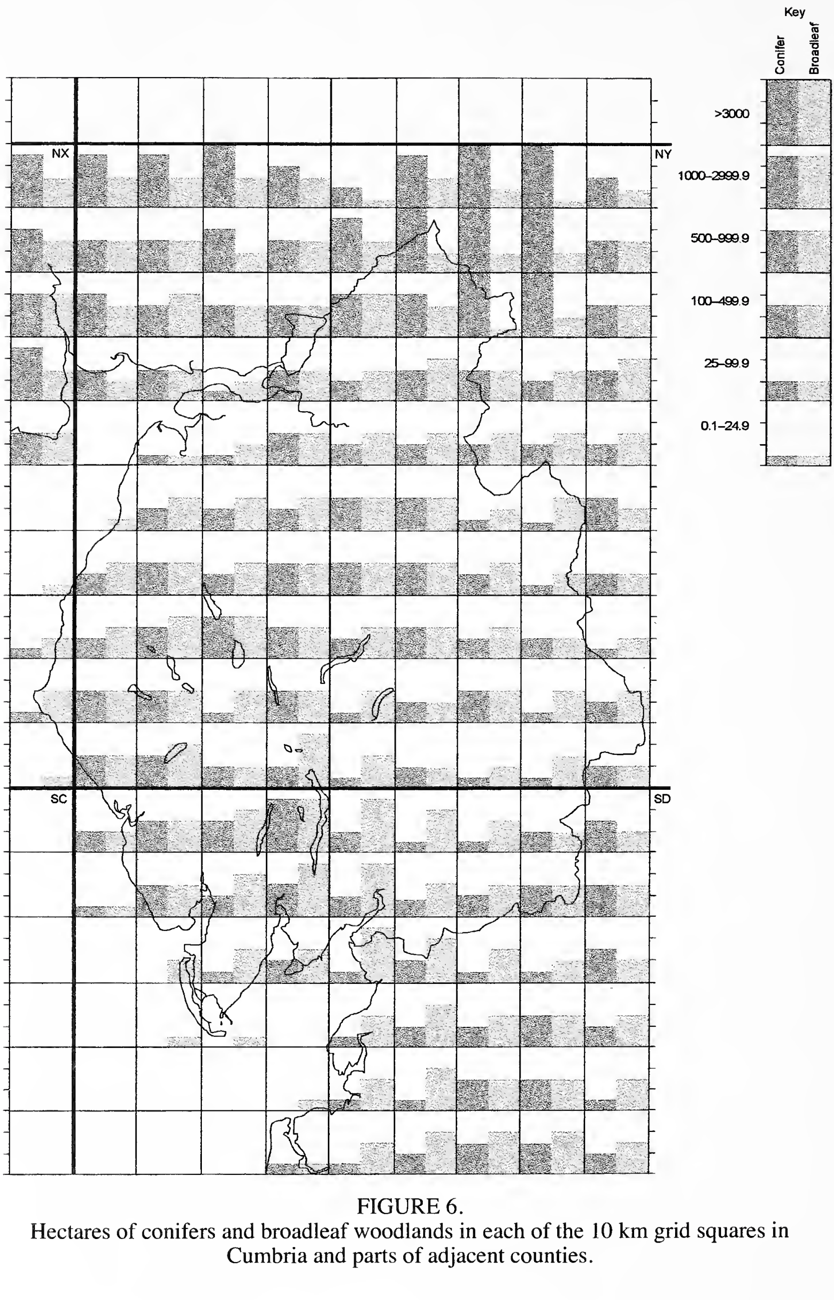

FIGURE 6.
Hectares of conifers and broadleaf woodlands in each of the 10 km grid squares in Cumbria and parts of adjacent counties.

1994, the grey squirrel was well-established throughout the forest, the Scots pine being a sufficient diet for this species without the admixture of broad-leaved trees. The red squirrel, although not extinct, was rarely seen except where it had been reintroduced (Venning, *pers. comm.*).

In Cumbria, assuming a conservative density of four grey squirrels ha^{-1} in broad-leaved woodlands, eventually there will be at least 118000, with an annual increment exceeding 50000. As the large seeded pines and fir trees will also provide a suitable diet and habitat for the grey squirrel, the future for the red squirrel looks bleak. However, as coniferous forests are the natural habitat of the red squirrel; it is probable that it has its best chance of survival in these forests.

On 28 September 1994 therefore, a special reserve for red squirrels was declared in Spadeadam (NY67) by Forest Enterprise. At that time there were no grey squirrels in this forest, the nearest being in woods to the east of Carlisle (NY4556). In the Spadeadam 10 km grid square, the ratio between areas planted with conifers (principally sitka spruce (*Picea sitchensis*)) and the hardwoods is 195 : 1. The only other 10 km grid squares in which the trees are predominantly conifers are the most northern three straddling the border between Scotland and England (NY:48, 58 and 68). In these the ratio is 38.7 : 1; as these squares are contiguous with Spadeadam, it is this region which has the best prospect of becoming the last refuge for red squirrels in Cumbria (see Fig 6). Elsewhere, deciduous woodland is dominant almost everywhere. Only isolated coniferous forests like Ennerdale (NY1015) may also offer the red squirrel a lasting refuge as long as the grey squirrel can be prevented from gaining access to them.

In Canada and America, the grey squirrel ". . . usually gives way to the more aggressive red in a confrontation. . ." (CWS, 1983). Thus, the reds (*Tamiasciurus hudsonicus*) keep the grey squirrels out of the conifers and the two species can co-exist. The species also has the added advantage of not being affected by parapoxvirus. In the UK, the native red squirrel is less aggressive, and is consequently more easily replaced in all types of woodland (Kenward *et al.*, 1994). Moreover, reintroductions of red squirrels into areas with greys have so far been unsuccessful, even when supplementary food has been provided in special grey squirrel-proof food hoppers (Bertram & Moltu, 1986).

If, therefore, current efforts to save the red squirrel fail and the species becomes extinct on the British mainland, it would still be possible to have a red squirrel in Britain, albeit another exotic like the grey squirrel, by introducing red squirrels from Canada and America into the larger coniferous forests. It would not be native, but the present races of red squirrels in Britain all stem from introductions and are therefore not native either; they are probably of Scandinavian or Continental origin (the original subspecies probably died out around the turn of the 19th century – Lowe & Gardiner, 1983), and are therefore technically also exotics.

However, the desirability of having any squirrels in Britain has been questioned, because of the damage both species do to commercial tree plantations. As Ritchie (1920) wrote ". . . the spread of the grey squirrel threatens us with a plague as grievous as that which has rewarded the well-meant efforts of the enthusiasts who set the Common Red squirrel free in our woods, that his interesting presence might add to the delights of Nature Lovers" (p. 290).

Acknowledgements

None of these data would have been available except for the time and care landowners or their agents and pest controllers took in looking out their records. We are also very grateful to David Howard for abstracting the woodland data from the Countryside Information System, to Karen Goodsir for her help with the figures, and to Robert Kenward for his comments on an earlier manuscript.

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THE TWO BRITISH *ALEURITIA* PRIMROSES: 1. DISCOURSE WITH GRAPHICAL DOCUMENTATION

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INTRODUCTION

Despite all the species-specific information on ecology and demography of the two *Aleuritia* primroses, and relevant horticultural information, ecological comparisons are difficult. The reasons for the present allopatric distributions of *Primula farinosa* (Northern England) and *P. scotica* (Northern Scotland and Orkney) are elusive. Much of the known natural history of these, and other taxa, is embedded in the scientific literature. It is often statistically complex, containing considerable tabulated data, and is therefore relatively unperused, even by professional biologists in related fields; certainly it escapes the attention of the majority of non-professional naturalists. It is hoped that this article will provide a partial remedy.

The relative ease with which mathematically uncomplicated graphs may now be produced in a condition presentable for publication (e.g. by means of Microsoft Excel), and the cheapness of colour reproduction, allow much information to be transmitted at a glance. It is this facility, exploited by every newspaper, and by the UK Phenology Network (www.phenology.org.uk) that will be used here. The phenology of a number of widespread and abundant species is used by the Network to monitor climate change. Here two scarce species are currently being monitored at one site.

The imminence of drastic and unpredictable climate changes, at least as great as those of the Early Quaternary, suggests that local, and possibly global, extinction of many taxa with special habitat requirements is likely, especially in Britain where migration is inhibited by the built and agricultural landscape. This is therefore a particularly opportune time to augment the natural history of species such as *Primula farinosa* and *P. scotica*, by documenting and comparing their present behaviour in the open, at a given latitude outside their natural ranges, and for a long period. Therefore a technique to illustrate aspects of the natural history of the two Primroses, with particular reference to developmental and phenological differences is tested – monitoring samples (effectively small populations) of the two taxa under the same conditions out of doors. Graphical interpretations of both annual processes, and of the year-on-year observations will be presented with comments, and reference to observations in nature.

Classic studies on ecotypic diferentiation *within* species by J. Clausen and associates have long passed into the general literature (see for example Stebbins, 1950). They often involved reciprocal transplant experiments. There is evidently ecotypic differentiation between populations of *P. farinosa*. Sometimes this involves gross morphological differentiation, as demonstrated, for example, by Arnold (1999) by transplant experiments between short- and long-scaped populations. Reciprocal transplant experiments could yield insights into the comparative survival mechanisms of *P. farinosa* and *P. scotica* which early in the last century were considered sufficiently close as to be included under *P. farinosa* by Bentham and Hooker (1945). Such work is now unlikely to be undertaken.

However, non-reciprocal transplant experiments involving the variable seed weight of each species have been carried out by Tremayne and Richards (2000). One clearly demonstrated conclusion was that two habitats differentiated climatically by altitude mediated potentially gross differences in vegetative performance (indicated by rosette diameter) of. *P. farinosa* transplants: at a low altitude site light seeds appeared to be associated with a longer term advantage; the weight differences were found not to be heritable. Another conclusion was that over two seasons at a single site *P. scotica* transplants derived from seeds of low weight may have been at no great disadvantage. In

solitary culture any initial size 'advantage' of the seedlings produced by larger seeds in *P. farinosa* failed to persist. It might be thought that the heritable difference in average seed weight and dimensions between the two British *Aleuritia* primroses is adaptive – but how? Seeds of both species will germinate as soon as they are shed, although cold stratification after dry storage is recommended (see Tremayne & Richards, 2000). Such germination, at least of seeds from the first flush of flowering must occur in nature, where the full cycle to first flowering will then resemble that of a biennial (see Ritchie, 1954).

It was reported by Bullard *et al.* (1987) in a demographic study of *P. scotica* that plants located early in their study survived longer than most later arrivals (some for more than 14 years). Such longevity, they suggest, may be attributed to selection for temporarily favourable genetic recombinations arising from occasional outbreeding events 'during peak flowering years'. An alternative, and additional, hypothesis might allow that favourable microsites, produced more abundantly in some years by external stochastic events, could allow genets with no exceptional genetic constitutions to consolidate an initial advantage not available to later cohorts. Some genets of *P. farinosa* are also long-lived in nature, but it is seed-dependent and [generally] has a short life-span (Bradshaw & Doody, 1978). Continuous grazing was found to be correlated with population persistence by Lindborg and Ehrlén (2002), who noted that 'ramification by daughter rosettes' was rare in their study populations, and that recruitment from seeds is common. The *strategies* for survival of the two species seem similar – i.e. to exploit newly available microsites in grazed herbaceous vegetation through copious seeding, whilst retaining old sites for as many years as possible. How do their *tactics* compare? The italicised terms are naturally used as a convenient metaphor, and in no way imply 'design' or pre-meditation!

Material, Procedures and Acknowledged Limitations

P. farinosa was grown from seed collected in North Yorkshire and *P. scotica* seed was provided by the Royal Botanic Garden, Edinburgh. The species were grown together in a peat-based growing medium (Viking Horticultural MM – medium structure compost – Plains House Farm, DN2 5SN) in 25 cm diam. plastic pots to minimize differences in their environments. Ten pots were used, allowing continual observations of 30 plants of each species; three seedlings of each species in each pot were spaced-out to avoid competition and overcrowding (Fig. 1).

There can be no possibility that the small populations of any taxon used in such experiments are entirely representative, but it is anticipated that major species differences will not be overriden or obscured by this drawback, or by experimental noise: not every specimen is assured of identical conditions to every other, even in the same pot.

Data were obtained as frequently as possible through measurement and counting of plant parts for a number of years. Although some 'plants' of an original cohort (n = 30) of *P. farinosa* genets derived from seed in 1999 have remained recognizable to the present, those of *P. scotica* became gradually obscured, partly through deaths, and partly through recruitment of seedlings which rapidly became indistinguishable (without excavation) from original 'plants', necessitating abandonment of recording.

All ten pots were on level ground exposed to the south but subject to partial shading from trees in early morning and evening. The pots were rotated and 'shuffled' as often as practicable to, at least partly, even out the conditions to which each plant was subjected. Watering was minimal, and confined to long dry spells. No fertilizer was provided at any time.

Observations in published field studies of *Aleuritia* primroses relate only to aerial parts of the plant. Here quantitative observations on the shoots are supplemented by brief notes on underground structures observed in the field.

Graphs, Observations and Comments: the shoot

The shoot system of both primroses consists in its early stages of a single axis bearing imbricate sessile leaves; each leaf has a wide, sheathing base, which is white, rich in starch,

FIGURE 1.
Experimental arrangement summarized. 10 such pots on a gravel base, each containing three numbered plants of both species. All protected by plastic-coated wire mesh (not shown).

and free of chlorophyll, with above it, a narrowed region, which appears petiole-like in *P. farinosa*, particularly in the summer-formed leaves. Both species produce sessile axillary buds, whose growth must be inhibited at first by the apical meristem. These are evident as 'bulbils' in the dormant bulb, and more may appear among the older leaf bases in the growing shoot. Their release from inhibition must depend on 'morphological distance' (number of nodes) from the shoot apex, and their growth (bud break) on temperature.

Floristic primordia are present at all times of the year, and first become recognizable among the oldest leaf bases of a shoot or ramet; their initiation also appears to depend on distance from the inhibiting apical meristem, and their development or failure on the environment. It is suggested here that the morphological distance from a shoot apex governing inflorescence development may be much shorter in *P. scotica* than in *P. farinosa*. Both of these perennial species (after release from temperatures close to 0°C), emulate, in their second spring, the bolting behaviour typical of biennials with one or more flowering shoots developing from among the leaves of a rosette and elongating rapidly. Flowering will be considered in a subsequent article.

It is, at present, unclear how long a vegetative axial meristem persists in either primrose. Photographs (Hambler, 2004) show a four-year-old *Primula farinosa* genet in culture, seen from above, and a presumed genet of unknown age in the field. The latter comprising four separate ramets of equal size is irregular, like its surroundings. The former comprising more than 15 entirely separate rooted ramets appears circular in outline with no larger 'parent' shoot distinguishable at the centre of the circle. The *P. farinosa* 'plant' therefore

does not *ramify* from a major axis. Not all of these axillary shoots (the secondary rosettes of Tremayne & Richards, 2000) survive even their year of origin, although some may themselves produce 'daughters'. Each shoot is capable of rooting, and *becomes* a ramet as its link to a parent axis is severed. Although, in the cultivated material, the number of ramets per genet increased yearly in the absence of competition, the increase was not exponential. Shoot mortality (Fig. 2) is evidently a constraint. It may be that the embryonic shoot meristem of *P. scotica* is generally far more persistent than that of *P. farinosa*, although the hard dead 'trunk' of some *P. farinosa* shoots in the field (Fig. 7a) suggests prolonged axial growth of a single rosette.

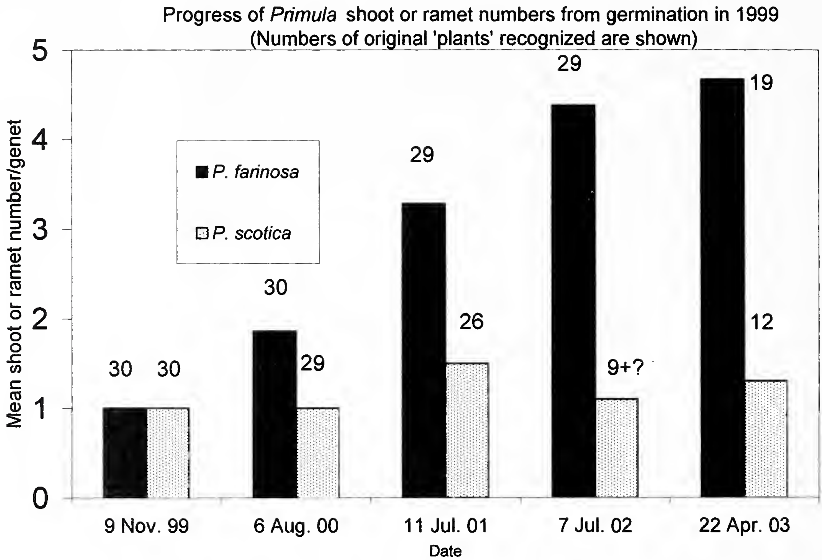


FIGURE. 2.
Continuing increase in the number of shoots or ramets per genet for *Primula farinosa*. Stabilization in the number for *P. scotica* by its second summer. A decrease in the number of recognizable genets for each species is more accentuated for *P. scotica*

After germination in the summer of 1999, all plants of each species had produced about three foliage leaves, and an apical silvery-farinose bud or bulb 'disappeared' among the dying leaves until April when it generated new foliage, initially through expansion of the dormant external leaves of the tiny bulb. Initiation of this process was slightly earlier for *P. scotica*; but, as Figure 3 shows, *P. farinosa* had outstripped it by August with some 16 expanded leaves per plant compared with 12 for *P. scotica*.

That *P. farinosa* is the larger plant is axiomatic, although both species can become far larger than 'normal' in glasshouse cultivation. One aspect of size might be the diameter of a rosette (Fig. 4). This measure has been used in ecological studies of both species (see Lindborg & Ehrlén, 2002 for *P. farinosa*; Bullard *et al.*, 1987 for *P. scotica*; Tremayne & Richards, 2000 for both species). Changes in diameter are progressive during any single annual cycle; this measure is useful in ecology, and for demographic studies, but only as long as the 'plant' remains as an approximately discoid rosette, and only if measurements are made at the time of maximum vegetative expansion. Secondary rosettes were noted in cultivated materal by Tremayne and Richards (2000), and clonal ramets of *P. farinosa* are

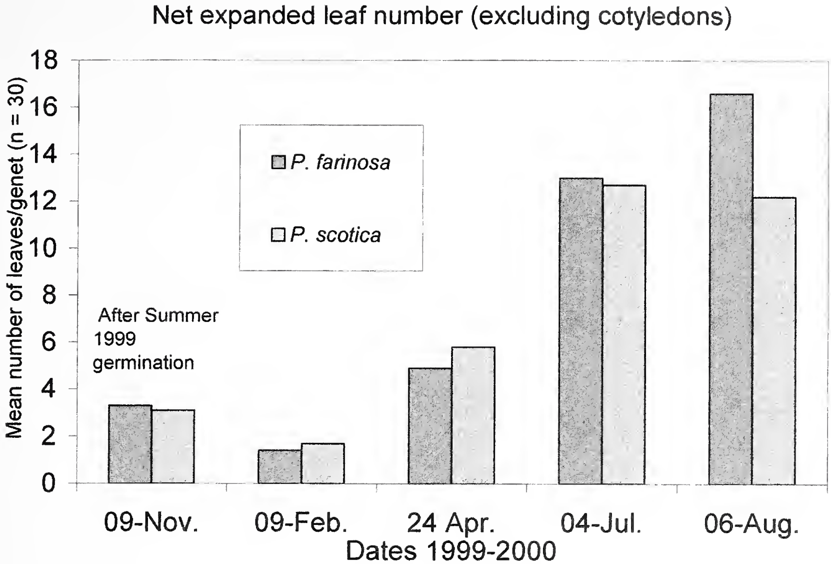


FIGURE 3.
Primula farinosa gradually gaining ascendency in leaf number over *P. scotica*.

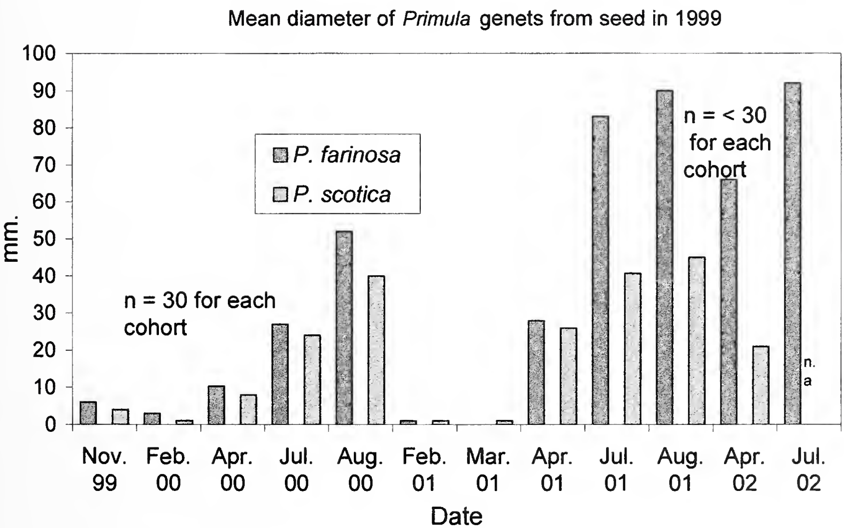


FIGURE 4.
Changes in the maximum diameter of *Primula* genets from first year onwards.

evident both in culture and in the field. Their importance to the survival of each species is not known, although a *relative* lack of ability to spread laterally might, among the evolving sympatric anticedents of the two species, have propelled ancestral '*P. scotica*' into marginal, less crowded sites.

The exposed aerial component of both species in culture was negligible in winter, and during the second and third years (2000 and 2001) *P. farinosa* again attained ascendency from April onwards. The maximum diameter for both species was attained in August. How these figures relate to size in wild populations is somewhat uncertain. For *P. farinosa* there may be no relevant statistical data on size published: even Lindborg and Ehrlén (2002), using both 'rosette' and 'size' in a statistical analysis of populations presented descriptive stages (reproductive, large vegetative, small vegetative etc.) without raw data.

For *P. scotica*, the Bradford cultivated material attained in the August of its first few years a mean diameter of *c*. 40 mm, i.e. 8 mm greater than the mean maximum of 32 mm given by Bullard *et al*. (1987) who provide the only published data from the field. A conclusion from this observation is that the outdoor conditions of the cultivated plants in Bradford were not grossly adverse for *P. scotica*. The plants in all the field studies referred to above were described as rosettes – even as 'individual rosettes' by Lindborg and Ehrlén (2002).

The individual rosette condition was soon obscured in experimental *P. farinosa* through vegetative proliferation (see Hambler, 2004), whilst such proliferation appeared vestigial in *P. scotica*. Although Figure 2 showed that the mean number of distinct shoots or ramets of *P. scotica* genets increased only into the second growing season, thereafter stabilizing for two subsequent years, the mean number for recognizably original *P. farinosa* genets had continued to increase even into the fifth year. The decline in number of recognisable original genets for each species is illustrated by the sample size shown. More importantly, perennation of both is clearly illustrated. Whilst self-seeding of *P. scotica* allowed it to maintain a population of at least 30 rosettes under the artificial conditions, the original genets remained small. Eventually these survivors could no longer be distinguished from later arrivals or saved from eventual crowding-out by the more competitive *P. farinosa* genets.

A degree of longevity for both species is illustrated by Figure 5, where 23 genets of *P. farinosa* and nine genets of *P. scotica* could be recognized with certainty five years after germination but, at this time, the modal shoot/ramet number per genet of *P. farinosa* was six (with a range up to 28) and that of *P. scotica* was one with a range extending only to five. This undoubtedly reflects field conditions with the single rosette of *P. scotica* representing either an apical meristem persistent from the seedling stage, or signifying that shoot production and mortality are extremely finely balanced in nature.

Figure 6 illustrates how two components of plant size are related in *P. farinosa*. The number of expanded photosynthetic leaves of a single plant (initially one isolated ramet or bulb) and the number of patent axillary shoots increased in tandem from mid-January until late August. At this time the genet was a single plant; it subsequently senesced into its winter state with the loss of one apical meristem. This neatly illustrates a survival 'tactic' for the species: provision of a number of sessile shoots able to root freely even before they become independent through severence from the axis on which they originated. Figure 7 illustrates this process in nature; a genet survived despite being deprived of its infloresences by a grazing mammal, probably a sheep, and was in process of being dispersed over a small area through soil slippage. In the field this species may be gregarious at an extremely local level (Hambler & Dixon, 2003), small groups of plants having been recorded in the freely-drained grassland of Teesdale (Bradshaw, 1985) and at Hawes Water (Tremayne & Richards, 2000). Whilst such grouping in *P. farinosa* often appears to result from vegetative proliferation the 'neighboured plants' of *P. scotica* recorded by Bullard *et al*. (1987) appear most likely to owe their co-proximity to seed-fall from a parent.

Recruitment of 'new individuals' to the Swedish populations studied by Lindborg and

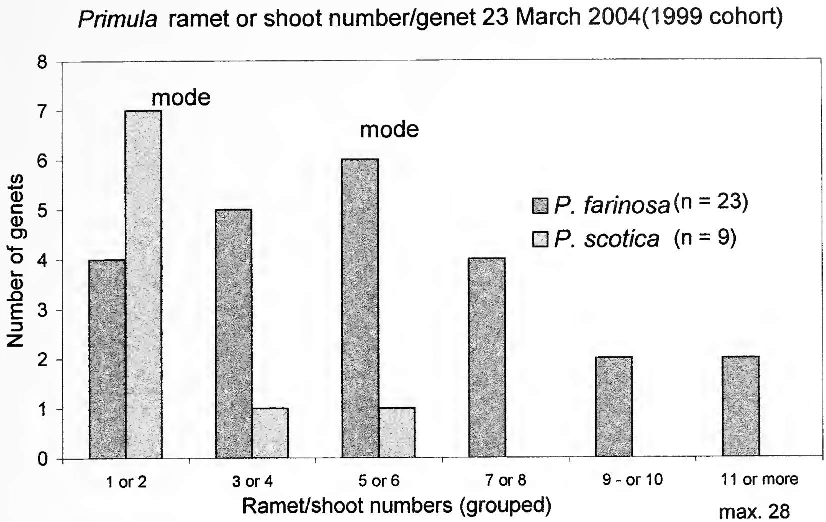


FIGURE 5.
The modal ramet or shoot number in the fifth year was much higher in *Primula farinosa* than *P. scotica*.

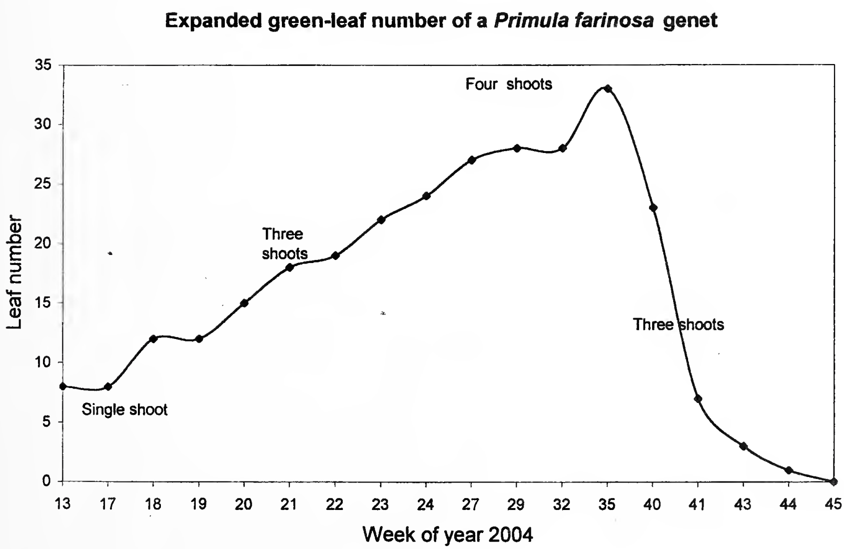


FIGURE 6.
A season of vegetative increase and decline in a single 'plant' of *Primula farinosa*.


A
B
C

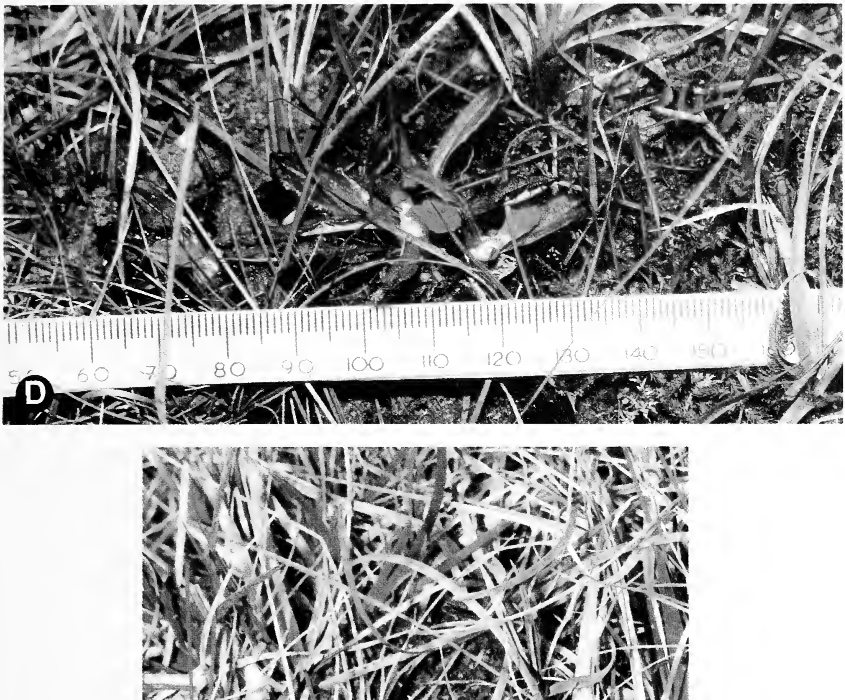


FIGURE. 7.
Primula farinosa. One genet's vegetative proliferation on an eroding *Sesleria albicans* tussock: (a) 9 May 2003: an old atypically compound rosette; (b) 7 July 2003: plant damaged through grazing, several scapes truncated; (c) 8 August 2003: vegetative recovery; (d) 10 November 2003: compound rosette dividing and senescing; (e) 8 May 2004: resumption of attempts to flower.

Ehrlén (2002) was recorded, and production of 'daughter rosettes' was rare. The relative abundance of clonal groups and mono-axial rosettes in British populations is therefore of interest. Careful study of Figure 7a suggests that at least three shoot apices were present comprising an atypical 'compound rosette' in May, and that by November only two remained, possibly still linked. Here a thick hard vertical axis may have existed for (? many) years and be the product of a persistent meristem. Explanations are needed to reconcile this observation with the rapid separation of ramets in culture, and with other field observations including those of Lindborg and Ehrlén (2002); as an aside, it may be noted that both leaves and shoots show evidence of grazing by sheep or rabbits – an observation possibly at variance with these authors' comment that livestock do not remove vegetative parts of *P. farinosa*.

In cultivation, *P. farinosa* has a reputation for being short-lived according to Smith *et al.* (1984), and is described as neither so vigorous nor so long-lived as a close relative *P. frondosa* by Richards (2002). However, there seems little reason why genets of either species cannot persist indefinitely, even in Bradford, although stochastic 'accidents' alone will be more likely to destroy one apical meristem than several. Genets of both species are most vulnerable immediately after germination, but *P. scotica* retains this vulnerability. Within a year, however, *P. farinosa* has shown a greater inherited predisposition to insure against such accidents.

A survival tactic of *P. scotica*, apparently, is to retain, and depend on, its embryonic apical shoot meristem throughout its existence, with nearly all axial meristems diverted into flowering mode. Mechanical insult, or environmental conditions encouraging excessive flowering may divert resources needed for overwinter survival of the indispensible apex: garden raised plants of *P. scotica* soon 'flower themselves to death' even in Orkney (Bullard, 1976, and *pers. comm.*). The mono-axial tactic may be appropriate in low sub-arctic grassland where a rosette is only slowly outcompeted.

The shoot axis is vertical in both species, and therefore the potentially hemicryptophytic habit must be lost in the long term. This, probably critical, eventuality may be postponed for longer in *P. farinosa* where detached ramets separate laterally, and in culture remain at the same level. In the second full summer after germination (2001) both species flowered; a

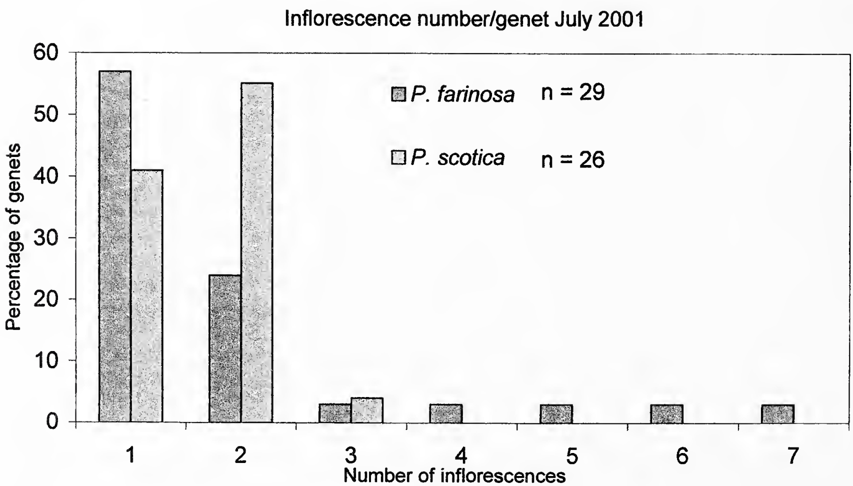
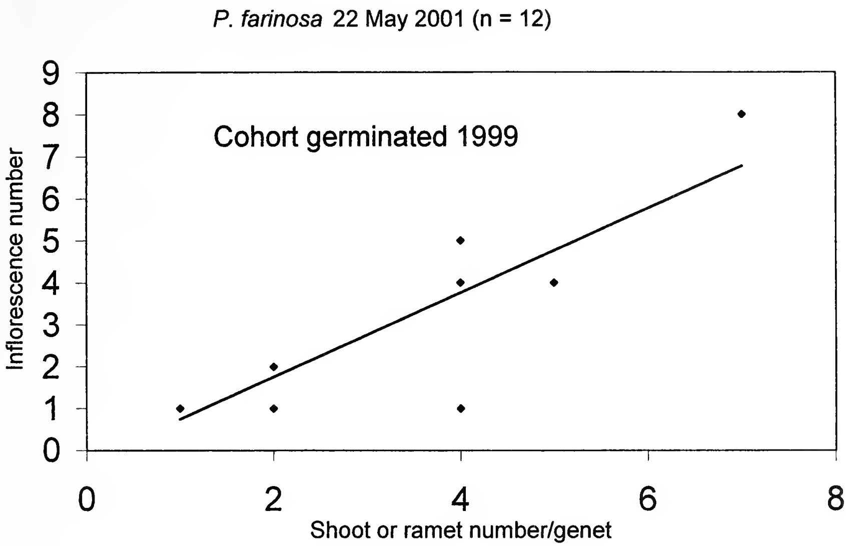


FIGURE 8.
Percentage of genets with a given number of inflorescences in their first flowering season.



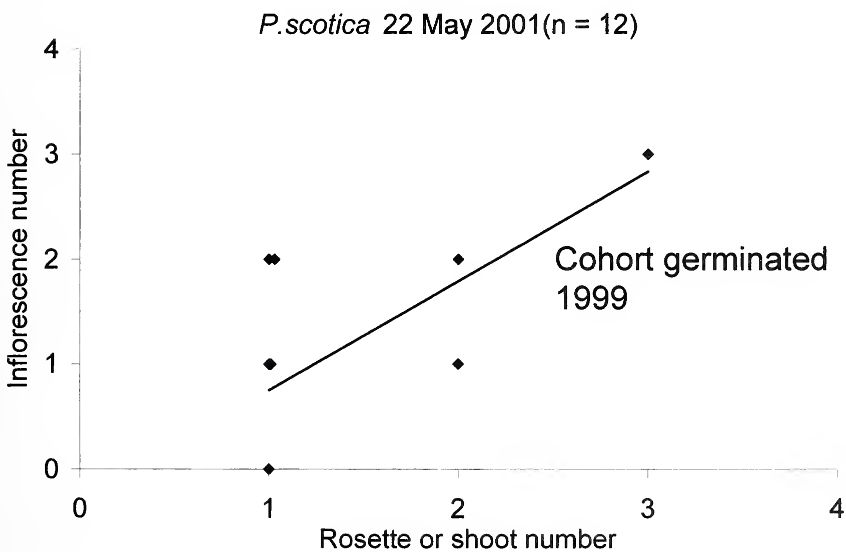


FIGURE 9.
A positive relationship between shoot number and inflorescence number in (a) *Primula farinosa* and (b) *P. scotica*.

propensity for *P. farinosa* to produce one inflorescence per mono-axial genet, and for *P. scotica* to produce two in its first flush was evident (Fig. 8). However, the latter showed a maximum of three in a small percentage of genets whilst a small percentage of *P farinosa* genets exceeded this number and extended to a maximum number of seven – this, at an early stage in a potentially indefinite existence.

The number of inflorescences produced by a genet of either species, in any year, is likely to be linked to the number of shoots or detached ramets (Figs. 9a & 9b). Although both values have here been shown capable of increase year on year for *P. farinosa*, a dearth of new vegetative meristems *indirectly* checks the possible number of inflorescences for a *P. scotica* genet. Both species are able to produce more than one flush of flowers, and more than one inflorescence, even contemporaneously, on the same shoot. A tactic common to both is to produce a later flush, 'weather permitting', as the first seed capsules ripen. Comments and references to literature on seed numbers per capsule may be found elsewhere (Ritchie, 1954; Hambler & Dixon, 2003; Tremayne & Richards, 2000). Despite differences in number of capsules per scape (higher in *P. farinosa*) and number of seeds per capsule (higher in *P. scotica*), no significant difference in average overall fecundity (i.e. total seeds produced per genet) of the two species across population/years was found by Tremayne and Richards (2000). If this is true in nature, the similarity in survival strategy of the two species is striking.

Thus far only the first (and sometimes the only) flush of flowering of the primroses has been considered. Both species attain a vegetative maximum shortly after the longest day of the year, and both are in full flower long before this time. The timing of these events will be considered in a later contribution. Graphs, partially notional, illustrating this timing are provided by Hambler (2004).

It is intended to provide further documentation on the natural history of both species. Rapid year on year unidirectional climate change is taking place and may soon render such documentation of historical rather than current interest. Established individuals of *P. farinosa* have a more constant performance, and are less responsive to habitat quality than recruits, according to Lindborg and Ehrlén (2002); this is perhaps evident in the near stability over ten years in a small population in Teesdale (Bradshaw 1981) where 'it flowers well but seed production is low' (despite considerable fluctuations in other species). The lack of persistence of recruits in populations of *P. scotica* (Bullard *et al.*, 1987) has been discussed above. As climate change bites, therefore, *Aleuritia* populations comprising long-established plants may, for a while, remain deceptively stable.

ACKNOWLEDGEMENTS

Thanks are due to Elaine Bullard for her encouragement and for any insights I have gained during our telephone conversations, to Elizabeth Arnold for permission to paraphrase information from her PhD thesis – I blame neither for any of my opinions or conclusions – and to Mark Seaward for his patient editing of this contribution.

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BOOK REVIEWS

Guide to Ladybirds of the British Isles by **Michael Majerus, Helen Roy, Peter Brown** and **Remy Ware.** Available from: Field Studies Council Publications, Preston Montford, Shrewsbury, Shropshire SY4 1HW. Price £3.50, including postage and packing.

The Field Studies Council, with the support of the Royal Entomological Society and the Linnean Society, have maintained the high standards expected of them by producing this AIDGAP fold-out chart to a popular group of insects. The laminated chart, which contains illustrations by Chris Shields, depicts the 26 species of typical ladybirds. The other ladybirds (*Nephus, Scymnus* etc.) are beyond the scope of the key and are not covered. The excellent illustrations, some species having more than one due to individual variation, capture the 'jizz' and allow determination of most species to be made relatively easily. My only criticism concerns the lack of any illustration of *Propylea 14-punctata,* the commonest form, with a black U-shaped mark on the elytra. The Harlequin Ladybird *Harmonia axyridis,* only discovered in Britain in 2004, has four illustrations along with discussion concerning its biological impact on biodiversity.

Each species is shown with the common name followed by the Latin name. Although not advocating the use of common names, these names are not recently contrived and have been in existence for a good number of years. Common names are totally inconvenient for the larger groups of beetles (or organisms in general), but lend themselves to a small group such as the ladybirds. In general, although the public can be discouraged by Latin names, I feel the Latin name should have been given precedence.

The chart is packed with useful information, and a table with the headings: Species, Status, Colour pattern, Habitat, Overwintering site and Distribution, is easy to use and very informative. The aims of these Guides are to produce user-friendly identification charts and raise awareness about the natural world – in this it excels.

MLD

Endangered. Wild life on the brink of extinction by **George C. McGavin.** Pp 192, with numerous coloured illustrations. Cassel, London. 2006. £20 hardback.

At first glance I thought that this may be just another attractively illustrated popularisation of how our world is losing some of the wonderful creatures with which we share it. It is, however, a fact-filled compendium that not only documents how we are destroying our irreplaceable heritage, but also the alarming future that faces us if we do not mend our

ways. Readers will surely wonder if we can. Introductory sections include an account of man's origins, how he has increased in numbers, recently at a frightening rate, and what this has done to the rest of the world's fauna.

Most of the book is a taxonomically arranged overview under the heading "The lost and the last". Each major group of animals is usually given a double page spread that summarises how it is faring. All too often the verdict is 'not well' – or worse. The list of species that have declined catastrophically, are on the brink of extinction or have already gone is long and depressing. When it is appreciated that the now extinct Passenger Pigeon was perhaps the world's most numerous bird, and that in the 1980s the Newfoundland Cod fishery was still yielding 250,000 tons a year but that by 1994 the biomass of the entire population was estimated to be only 1,700 tonnes, man's destructive power is easily appreciated. Threats from such introduced animals as cats, dogs, rats, pigs, foxes, stoats, mink, mongooses, rabbits, toads, various birds, and many different fishes, as well as invertebrates, that have upset ecosystems and led to extinctions are also vivid reminders of his stupidity. When one adds habitat destruction on a massive scale, pollution, hazards ranging from oil slicks to contamination by toxic chemicals, and many others specific to particular species or groups of animals, the picture is depressing indeed. Man-induced climate change may make things worse. The obvious solution, a dramatic reduction of the human population, is at present merely a dream. In the past 50 years it has more than doubled to over 6 billion and may reach 10 billion by 2050. A few bright spots lighten the gloom, but it is difficult to be optimistic.

The illustrations are often splendid, and if these and the message that the book conveys cause people to think about the problem and to adopt some of the suggestions made, some species may indeed be saved. On a world scale our problems are perhaps small, but not insignificant. They need to be addressed by common sense as well as science. Whether we can save the Red Squirrel – of which a simplistic view of its relationship with the Grey, receives only a brief mention – is doubtful, but the revived fortunes of such birds of prey as the Red Kite, White-tailed Sea Eagle and Peregrine Falcon show that not all efforts are futile. This book shows what we have lost and might lose. It should inspire those who believe that every man-induced extinction is a tragedy to make sure that as few as possible of earth's creatures join the Dodo, Great Auk, Passenger Pigeon, and so many others that no longer exist to delight us.

GF

Erratum

'Current status of the Dark Green Fritillary in Yorkshire' by T.M.Whitaker (*Naturalist* **131**: 105-116 (2006). The right-hand column of Table 8 (p.111) has been miscalculated, with the females given as a percentage of the males rather than of both male and females. Therefore the figures 51.43, 38.89, 10.20, 30.43, 50.00, 35.71 should be replaced by 34.0, 28.0, 9.3, 23.3, 33.3, 26.3 respectively. However, the overall conclusions are similar, but the proportion of females is even lower than originally discussed.

THE BEETLES OF SPURN PENINSULA: A THIRD UPDATE

M. L. DENTON
77 Hawthorne Terrace, Crosland Moor, Huddersfield HD4 5RP

The Beetles of Spurn Peninsula (Denton, 1995) documents the beetle fauna of this important Yorkshire Wildlife Trust reserve; two updates (Denton, 1997; 2004) brought together details of species located since this time together with a number of archival records that were not previously available. More recently, W.R. Dolling and the author have continued to collect along the peninsula, and these excursions have resulted in records which have added to the known distribution or, in some cases, added new species. With the addition of 10 new species, the Spurn list of Coleoptera now stands at 741.

All references to the 'initial survey' refer to the YNU Entomological Section visits between 1947 and 1953 (organised by the late W.D. Hincks) and all locality names mentioned below will be found on the maps in Denton (1995). Nomenclature follows Duff (2005). In compiling the list which follows, I am greatly indebted to W. R. Dolling (WRD) for supplying records, to R. J. Marsh (RJM) for identifying the Ptiliidae, and to Andy Gibson the Yorkshire Wildlife Trust warden who, at the request of the author, constructed grass piles at the Warren; as can be seen from the records below, these piles proved there worth.

Bembidion guttula (Fabricius). A single in rotting vegetation along the pond edge in 'Clubley's Field' on 30/10/06 (MLD) constitutes the third record. The previous records were from the *Phragmites* marsh during the initial survey and from pitfall traps at Chalk Bank on 14/8/01.
Bembidion lunulatum (Fourcroy). A single in rotting vegetation along the pond edge in 'Clubley's Field' on 30/10/06 (MLD) constitutes the fifth record. The previous records were from an unknown location on 14/8/49, the 'marsh meadow' on 4/6/50, on mud at the edge of 'Pallas's Pond' on 21/7/63 and along the edge of 'Boundary Dyke' on 21/7/63.
Agonum marginatum (Linnaeus). A single located in a pile of rotting vegetation along the pond edge in 'Clubley's Field' on 30/10/06 (MLD) constitutes the second record. The previous record was from the same location on 17/8/01. The species is locally distributed in marshy places, on bare mud at the sides of ponds and lakes, and on muddy coasts.
Demetrias monostigma Samouelle. A single example located in dune grasses at 'Wire Dump' on 16/8/06 (WRD) is the first record since 20/6/51. With the exception of specimens from unknown locations, the others were from the Humber shore near the Warren (exact location unknown) and along the Main Ridge. A widespread and local species which is mainly restricted to southern and eastern England, with records from parts of Wales.
Syntomus (=Metabletus) foveatus (Fourcroy). Specimens under *Lotus* spp. on the Humber shore south of the Warren on 31/8/05 (WRD) constitute the fourth record. The previous records were from the Humber shore (exact location unknown) and the Warren during the initial survey and in pitfall traps in the marram at the Warren on 13/7/01.
Megasternum concinnum (Marsham). A single from a dead gull near the Lighthouse on 16/8/06 (WRD) adds to the known distribution. All previous records were from Chalk Bank northwards.
Cryptopleurum minutum (Fabricius). Specimens located in grass cuttings on the Parade Ground at the Point on 2/11/05 (MLD) add to the known distribution. The previous records were from the Warren, the *Phragmites* marsh and the 'marsh meadow' during the initial survey.
Ochthebius auriculatus Rey. Two specimens from strandline refuse to the south of the 'Narrow Neck' on 16/8/06 (WRD) constitute the second record. The previous record concerned two specimens from the ponds in 'Clubley's Field' on 2/11/99. The species is afforded Notable B status and is found in shallow muddy pools in salt marshes and saline lagoons. The only other Yorkshire record is from Welwick Saltmarsh (TA31) on 30/10/99.
Acrotrichis atomaria (De Geer). A single female located in grass cuttings at the Warren on

30/10/06 (MLD det. RJM) added this nationally common species to the Spurn List.

Acrotrichis cognata (Matthews). A single female located in grass cuttings at the Warren on 30/10/06 (MLD det. RJM) added this naturalised species to the Spurn List.

Acrotrichis fascicularis (Herbst). A single female located in grass cuttings at the Warren on 30/10/06 (MLD det. RJM) constitutes the second record, the first being from the same location in 1950.

Proteinus brachypterus (Fabricius). Specimens located in grass cuttings on the Parade Ground at the Point on 2/11/05 (MLD) added this nationally common species to the Spurn List.

Proteinus ovalis Stephens. A single located in grass cuttings on the Parade Ground at the Point on 2/11/05 (MLD) adds to the known distribution. All previous records were from 'Clubley's Field' northwards.

Omalium rivulare (Paykull). Specimens located in grass cuttings on the Parade Ground at the Point on 2/11/05 (MLD) add to the known distribution. All previous records were from Chalk Bank northwards with the exception of specimens from an unknown location on the Humber shore.

Carpelimus foveolatus (Sahlberg). A single example from strandline refuse to the south of the 'Narrow Neck' on 16/8/06 (WRD) constitutes the first record since the initial survey. The other records were from the 'Canal Zone' (both adults and larvae very commonly) and the salt marsh at 'Wire Dump' (occasionally).

Stenus boops Ljungh. A single male located in grass cuttings at the Warren on 2/11/06 (MLD) constitutes the second record. The previous record concerned several specimens from Chalk Bank on 30/5/92.

Stenus nanus Stephens. A single male located in grass cuttings at the Warren on 2/11/06 (MLD) constitutes the second record. The previous record concerned a single female on mud at the edge of the 'Bomb Crater' on 23/7/63.

Sunius propinquus (Brisout). A single male located in grass cuttings at the Warren on 30/10/06 (MLD) constitutes the third record. The previous records concerned singles found in the nest of a mouse at the Warren on 8/6/50 and under old straw in 'Clubley's Field' on 23/6/90.

Astenus pulchellus (Heer). Several specimens located in a pile of rotting vegetation along the pond edge in 'Clubley's Field' on 30/10/06 (MLD) constitute the third record. The previous records were from the salt marsh at 'Wire Dump' and the marram area on the Humber foreshore (exact location unknown) during the initial survey.

Gyrohypnus fracticornis (Muller). Past records from the 'marsh meadow', the *Phragmites* marsh and along the Humber foreshore (exact location unknown) were questioned due to past confusion with *G. punctulatus* (Paykull). A single located in grass cuttings on the Parade Ground at the Point on 2/11/05 (MLD) reinstates the species on the Spurn List.

Philonthus marginatus (Muller). A single located in grass cuttings at the Warren on 30/10/06 (MLD) constitutes the third record. The previous records were from the 'marsh meadow' in 6/51 and the Point on 15/5/83.

Gabrius piliger Mulsant & Rey. A single male located in grass cuttings on the Parade Ground at the Point on 2/11/05 (MLD) added this nationally common species to the Spurn List.

Quedius boopoides Munster. A single male located in grass cuttings at the Warren on 30/10/06 (MLD) added this nationally common species to the Spurn List.

Tachyporus atriceps Stephens. A single located in grass cuttings at the Warren on 30/10/06 (MLD) constitutes the first record since being encountered, when said not to be common, in reed debris in the *Phragmites* marsh during the initial survey.

Nehemitropia lividipennis (Mannerheim) (=***sordida*** (Marsham)). A single male located in grass cuttings on the Parade Ground at the Point on 2/11/05 (MLD) adds to the known distribution. Previous records were from the Warren, the 'marsh meadow', the *Phragmites* marsh and along the Humber foreshore (exact location unknown) during the initial survey.

Liogluta longiuscula (Gravenhorst). A single male located in grass cuttings at the Warren

on 30/10/06 (MLD) constitutes the second record. The previous record was from grass cuttings at Chalk Bank on 12/7/01. Although widely distributed in Yorkshire, the species is rarely encountered (Denton 2003).

Philhygra (=Atheta) palustris (Kiesenwetter). A single male at 'Wire Dump' on 20/9/05 (MLD) constitutes the first record since the initial survey. During this period the species was said to be present in most areas along the peninsula where, at times, it was common in grass tufts at the Warren and very common in wet places on sea cliffs (exact locations unknown).

Microdota (=Atheta) amicula (Stephens). A single female located in a pile of rotting vegetation along the pond edge in 'Clubley's Field' on 2/11/06 (MLD) constitutes the third record. The previous records were from grass roots in the 'marsh meadow' on 17/6/47 and in tide line refuse on the Humber foreshore (exact location unknown) on 22/7/48.

Alaobia (=Atheta) trinotata (Kraatz). Specimens located in grass cuttings on the Parade Ground at the Point on 2/11/05 (MLD) add to the known distribution. All previous records were from the Warren northwards with the exception of specimens from an unknown location on the Humber foreshore and wet places on sea cliffs.

Datomicra (=Atheta) celata (Erichson). Specimens from grass cuttings at the Warren on 30/10/06 (MLD) constitute the second record. The previous record concerned a single male found under rhubarb leaves at the side of the Annexe on 16/9/96.

Datomicra (=Atheta) dadopora (Thomson). A single female located in grass cuttings at the Warren on 30/10/06 (MLD) added the species to the Spurn List. This locally distributed species had previously been recorded from 24 widely scattered Yorkshire localities (Denton 2003).

Atheta aeneicollis (Sharp, 1869) (=***pertyi*** (Heer, 1839)). Specimens from grass cuttings at the Warren on 30/10/06 (MLD) constitute the fourth record. The previous records were from a wet place on a sea cliff (exact location unknown) on 8/6/50, in grass cuttings at Chalk Bank on 12/7/01 and in pitfall traps at the 'Narrow Neck' on 14/8/01.

Atheta crassicornis (Fabricius). Males located in grass cuttings at the Warren on 30/10/06 (MLD) added this nationally common species to the Spurn List.

Chaetida (=Atheta) longicornis (Gravenhorst). Specimens located in grass cuttings on the Parade Ground at the Point on 2/11/05 (MLD) add to the known distribution. All previous records were from the Warren northwards with the exception of specimens from an unknown location on the Humber foreshore.

Oxypoda opaca (Gravenhorst). A single male located in grass cuttings at the Warren on 2/11/06 (MLD) constitutes the fourth record. The previous records were from grass cuttings outside Warren Cottage on 22/6/90, under old straw in 'Clubley's Field' on 23/6/90 and to the north of the Lighthouse on 11/3/95.

Aphodius foetidus (Herbst). A single located in grass cuttings on the Parade Ground at the Point on 2/11/05 (MLD) adds to the known distribution. This is the first record since being found commonly in the *Phragmites* marsh, the salt marsh at 'Wire Dump' and the 'marsh meadow' in 6/51.

Pria dulcamarae (Scopoli). Specimens located on the Humber shore near the Warren on 31/8/05 and on *Solanum dulcamara* at Chalk Bank on 16/8/06 (WRD) constitute the first records since the initial survey. The previous records were from the salt marsh at 'Wire Dump' and along the Main Ridge.

Cryptophagus distinguendus Sturm. Specimens located in grass cuttings on the Parade Ground at the Point on 2/11/05 (MLD) constitute the third record, the others being from vole droppings at the Warren on 19/7/48 and an unknown location on 25/6/91.

Cryptophagus laticollis Lucas. Several specimens located in a pile of rotting vegetation along the pond edge in 'Clubley's Field' on 30/10/06 (MLD) added this nationally common species to the Spurn List.

Atomaria lewisi Reitter. Specimens of this naturalised species located in grass cuttings on the Parade Ground at the Point on 2/11/05 (MLD) add to the known distribution. All previous records were between Chalk Bank and the Warren.

Ootypus globosus (Waltl). A single located in grass cuttings at the Warren on 30/10/06

(MLD) constitutes the second record. The previous record concerned specimens from cow dung in the 'marsh meadow' on 9/6/50.

Cartodere (=Aridius) bifasciatus (Reitter). Specimens of this naturalised species located in grass cuttings on the Parade Ground at the Point on 2/11/05 (MLD) add to the known distribution. All previous records were from Chalk Bank and the Warren northwards.

Cartodere (=Aridius) nodifer (Westwood). Specimens located in grass cuttings on the Parade Ground at the Point on 2/11/05 (MLD) add to the known distribution. All previous records were from the Warren northwards.

Cortinicara gibbosa (Herbst). Specimens located in grass cuttings on the Parade Ground at the Point on 2/11/05 (MLD) add to the known distribution. All previous records were from Chalk Bank northwards.

Melanophthalma curticollis (Mannerheim). Numerous examples on the surface of sand in marram tussocks on the North Sea foreshore at Chalk Bank on 16/8/06 (WRD) constitute the third record and add to the known distribution. The previous records were from the 'marsh meadow' on 18/7/48 and the Humber shore at the Warren on 21/6/90.

Omonadus floralis (Linnaeus). Specimens located in grass cuttings on the Parade Ground at the Point on 2/11/05 (MLD) add to the known distribution. With the exception of two records from unrecorded locations, all previous records were from the 'Narrow Neck' northwards.

Aphthona euphorbiae (Schrank). Specimens located near the Lighthouse on 16/8/06 (WRD) add to the known distribution. All previous records were from the Warren northwards.

Altica lythri Aube. A single at 'Wire Dump' on 22/9/05 (MLD) added this nationally common species to the Spurn List.

Cassida flaveola Thunberg. Specimens on *Honckenya peploides* on the Humber shore at the 'Narrow Neck' on 31/8/05 (WRD) constitute the second record, the other being from marram along the Humber shore (exact location unknown) on 15/6/47.

Ceratapion onopordi (Kirby). Examples on *Tripleurospermum* on the sea shore near the Sea Watch Hide on 31/5/05 (WRD) constitute the first record since being found in the *Phragmites* marsh on 15/8/49 and the 'marsh meadow' on 3/6/50.

Protapion ononidis (Gyllenhal). Specimens (3 males and a female) on *Ononis repens* beside the unpaved path at Chalk Bank on 16/8/06 (WRD) constitute the fourth record. The previous records were from an unknown location in 1898, the salt marsh at 'Wire Dump' on 11/6/50 and 'Clubley's Field' on 18/6/90.

Ischnopterapion loti (Kirby). Specimens to the south of Chalk Bank on 16/8/06 (WRD) constitute the second record, the other being from the Warren on 11/6/50.

Holotrichapion ononis (Kirby). A single located in grass cuttings on the Parade Ground at the Point on 2/11/05 (MLD) adds to the known distribution. The previous records were from the Lighthouse northwards.

Ceutorhynchus obstrictus (Marsham). Specimens found to the south of Chalk Bank on 16/8/06 (WRD) constitute the fourth record. The other records were from the Warren on 15/8/49 and 7/6/50 and the Point on 3/10/92.

Ceutorhynchus pallidactylus (Marsham). Examples located to the south of Chalk Bank on 16/8/06 (WRD) constitute the third record and add to the known distribution; the others were from the 'marsh meadow' on 14/8/49 and 'Clubley's Field' on 17/8/01.

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Printed in Great Britain by Titus Wilson & Son, Kendal ISSN 0028-0771

April-June 2007

Number 1061
Volume 132

The Naturalist

A QUARTERLY JOURNAL OF NATURAL HISTORY FOR THE NORTH OF ENGLAND

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Newly discovered writings of a parson-naturalist: the journalism of the Revd Francis Linley Blathwayt (1875-1953) – *Trevor Kerry*

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Published by the Yorkshire Naturalists' Union

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Institutions and Subscribers £30.00 (UK), £32.00 (elsewhere) Registered Charity No. 224018

THE LICHEN FLORA OF HULL: BIODIVERSITY UPDATE, 2002-2006

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Introduction

The role of lichens as environmental monitors is widely recognised since they are not only valuable as indicators of habitat stability and environmental continuity, but also as monitors of environmental quality, more particularly of air and soil (and more recently water) pollution. Their main role in this context has been to monitor sulphur dioxide air pollution, not only of stable and rising levels (Seaward 1993), but also decreasing levels of this pollutant. They can also be used to monitor other pollutants, some of which are manifesting themselves as a consequence of the reduction in sulphur dioxide levels; of particular interest in this respect is their use to detect and determine the extent of qualitative changes in air pollution, such as the impact of acid rain and hypertrophication (Seaward 1997; Seaward & Coppins 2004).

Historical context and baseline surveys

The establishment of baseline information through detailed lichen surveys adopting rigorous protocols is crucial for such monitoring programmes. Despite the establishment of an elaborate national database of lichen mapping by the British Lichen Society in 1963, Hull has received limited coverage until the recent surveys initiated by Kingston upon Hull City Council; the first, undertaken in February 2002 as part of the Hull Local Biodiversity Action Plan (Marshall 2002), provided the basis for an unpublished report (Seaward 2002) and a subsequent publication (Seaward 2004), and the second, undertaken four years later, provided the basis for a further unpublished report (Seaward 2006). Prior to this, from 1967 to 1970, B.J.Coppins had produced an unpublished preliminary list of East Yorkshire lichens which included a few species for the city and D.H.Smith visited the city as part of the BLS national churchyard survey, listing 17 species at Sutton-on-Hull in 1990 and 17 species at Hull Spring Bank (Western Cemetery) in 1995. However, this work, based mainly on studies of saxicolous species, did not provide an adequate baseline from which to gauge any form of environmental impact.

2002 Survey

Three days of intensive fieldwork by the senior author in February 2002 provided credible baseline data for (1) judging the current status of the city's lichen flora and determining the major factors affecting it, and (2) critically evaluating future impacts, deleterious or favourable, on that flora; this work was followed up by several day visits by the author in 2003 and 2004. There was clear evidence from this work that the city's lichen flora reflected atmospheric amelioration in terms of sulphur dioxide, complementing data derived from pollution gauges (see Kingston upon Hull City Council 2000, section 3.5), but also showed increased hypertrophication. Both these processes, which are widespread in Britain and indeed Europe, have been detected by lichenological surveys (Seaward 1993, 1997; Seaward & Coppins 2004), but their stage of development could not be accurately gauged for Hull at that time due to the limited baseline information available from earlier studies. The implementation of clean air policy and practices had undoubtedly impacted on the city's lichen flora as measured by the increase in biodiversity, particularly of epiphytic species, but there had also been a qualitative (as well as quantitative) shift, the prevailing species in a

wide variety of habitats reflecting extensive hypertrophication.

The 2002 survey investigated a wide variety of habitats: corticolous substrata (mainly tree trunks) supported varied and interesting epiphytic floras, and saxicolous substrata (stonework, brickwork, cement, etc.) occasionally provided a reasonably diverse lichen flora, but muscicolous (over mosses) and lignicolous (timber) substrata, even when impregnated with nutrient-enriched (mainly nitrogenous) dusts, were disappointing, while terricolous (on soil) species were non-existent. The fieldwork was based on zonal and transect studies, the former radiating from the old city centre, and the latter extending (according to accessibility) more or less along five compass points to the W, NW, N, NE and E; in each case as many of the above-named habitats/substrata as possible were investigated, but most attention was paid to epiphytes. In all, 54 taxa were recorded from the city during these surveys (Seaward 2004, Appendix A), which compared favourably with the biodiversity (155 taxa) of the lichen flora of rural areas within 5 km of the city boundary.

On the basis of the epiphytic flora, the city could be clearly demarcated into three zones in 2002 (Seaward 2004, Figure 1): an inner zone (I) of 1 to 4 species, an intermediate zone (II) of 5-8 species, and an outer zone (III) of more than 8 species; the variation in biodiversity within a zone and the abundance/percentage cover on a particular substratum were related to air quality in general and also to the level of hypertrophication. Further variations related to (a) habitat, mainly exposure *v.* shade, (b) tree species, (c) vandalism, and (d) inclination of the trunk. Many commonly planted trees, such as plane, beech, cherry and hawthorn, were poor for lichens. Trees at a slight angle to the vertical often provided a more favourable habitat for epiphytes. In the past, only mature trees would have been examined in such surveys, but, rather interestingly, occasionally some relatively young trunks were shown to support several species. Twigs, often overlooked in urban surveys, were examined since they frequently support species indicative of hypertrophication (Seaward & Coppins 2004), but generally proved unrewarding.

Generally speaking, in 2002 the epiphytic flora of the inner zone (I) was composed of one alga (*Pleurococcus*) and one or two ill-defined crustose species, including *Lecanora conizaeoides* (often infected by the fungus *Athelia arachnoidea*); however, *L. conizaeoides*, which for the previous half century dominated urban environments, was clearly on the decline, as exemplified by Hull where it was only occasionally found, usually on timber or stonework. Additionally, *Phaeophyscia orbicularis* was frequently found in this zone, occasionally, according to the level of hypertrophication, with 1 to 5 species of *Physcia* and *Xanthoria*.

The epiphytic flora of the intermediate zone (II) in 2002 was composed of all of those species found in the inner zone together with *Parmelia sulcata* (rarely *Hypogymnia physodes* and/or *Lecanora expallens*) and, according to the level of hypertrophication, one or more of the following: *Lecanora dispersa* and *L. muralis* (tree bases only), *Physcia caesia*, *P. tenella*, *Physconia grisea* and *Xanthoria candelaria*.

The epiphytic flora of the outer zone (III) in 2002 was composed of all of those species found in the inner and intermediate zones (although *Pleurococcus* and *Lecanora conizaeoides* were less frequently encountered), with the addition of one or more of the following: *Amandinea punctata, Candelariella reflexa*, *Evernia prunastri*, *Flavoparmelia caperata*, *Hypotrachyna revoluta*, *Melanelia subaurifera*, *Punctelia subrudecta* s.lat., *Phlyctis argena* and *Ramalina farinacea*.

In terms of radial transects in 2002, the lichen flora (particularly the epiphytes) significantly improved with distance from the city centre in all directions, with the exception of the easterly route where only a marginal improvement was detected; it was also noticeable that along the westerly route the epiphytic flora improved almost to the optimum detected anywhere in the city, only to decline at c. 200 m from the city boundary approaching Hessle.

As has been subsequently proved, this survey work was undertaken at a critical time in terms of the recovery of the city's lichen flora, as demonstrated by the short-term shifts in distribution and habitat extension within the space of only two to four years. It should be noted that urban environments provide an artificially high and remarkable array of habitats

and substrata, and that once the prevailing factor (air pollution) dictating the lichen flora has been alleviated, such an environmental diversity will naturally be exploited by lichens.

Although much of the work in 2002 concentrated on the epiphytic flora, some attention was paid to the wide variety of other substrata to be found in urban environments. However, no terricolous species were recorded and urban distribution patterns were less easily discerned for saxicolous and lignicolous species, although biodiversity counts in particular habitats and autecological studies of selected species have proved useful in the past for bioindicational scales of air pollution monitoring (e.g. Seaward 1976). In all, 24 saxicolous and one lignicolous species were recorded, but it should be noted that many of the former were also to be found on dust impregnated (often nutrient-enriched) living and dead wood substrata. Truly maritime species on shoreline sea defences (stone- and timber- work) were not encountered and maritime influences on the Hull lichen flora in general were undetectable.

A complete inventory of the 54 lichens recorded in the 2002 survey was provided in Seaward (2004, Appendix A), together with details of the zones (I, II and III) in which they occurred, the substrata on which they were recorded, and some level of overall frequency. All these species were encountered in the 2006 survey and have been incorporated into a revised list (see Appendix), which provides some measure of any change in their status over the past four years.

2006 Survey

The commission work undertaken by the first author on behalf of Hull City Council was supplemented by detailed studies by the second author for the 2006 survey. Whilst accepting that the 2006 survey was more detailed than that undertaken in 2002, there have been dramatic changes to the lichen flora over major areas of Hull during the four-year period in terms of the status and distribution of many taxa (Seaward 2006). These changes testify to both quantitative improvements in air pollution, particularly sulphur dioxide, and to qualitative shifts in atmospheric burdens, particularly in respect of increasing nutrient and chemical enrichment of both air and dusts.

The zonal distribution patterns elucidated in the 2002 survey (Seaward 2004, Figure 1) are less discernible now due to what appears from detailed field observations to be a random invasion of lichens, often sensitive taxa, into many areas previously diagnosed as being relatively hostile environments. Nevertheless, a closer examination of these reinvasions highlights those areas which have clearly responded in the short-term to environmental amelioration, and, on the other hand, low biodiversity counts based on epiphytic lichen assemblages can still be employed to monitor hot-spots in need of environmental improvement. However, an overall geographical pattern can no longer be derived from transect data radiating from the city centre outwards as was demonstrated in the 2002 survey. Transects from the city centre to the west and to the east no longer effectively demonstrate air quality gradients, and although those to the northwest, north and northeast are indicative of underlying trends, they are punctuated by sites, and indeed niches, where poor lichen assemblages highlight local problems brought about by environmental disturbance, usually pollution, or, on the other hand, improved assemblages reveal local environmental amelioration.

The above trends are not necessarily revealed by biodiversity counts, the practice most frequently adopted for environmental monitoring, but by targeting selected species in order to determine their geographical distribution and ecological performance relative to particular factors. In the past, even as recently as the 2002 survey, Hull's lichen flora was clearly dictated by the pollution burden. However, the nature of this burden has clearly changed over recent years, both quantitatively and qualitatively; although sulphur dioxide, the major factor responsible for the decline in lichen floras, has been significantly reduced, other chemical components (the effects of some no doubt suppressed in former burdens) have manifested themselves and are now dictating the lichen flora.

One such factor is eutrophication, which arises from chemical and nutrient enrichment of

the environment; however, this enrichment is in excess of that regarded as a natural process, and is best described as hypertrophication, the effects of which are now dictating rural, and more recently urban, lichen floras, as witnessed in Hull; other than in the most polluted areas, wherever there are suitable trees, nitrophytic lichens bear testimony to this transformation. Those familiar with the epiphytic lichen flora of Hull two decades ago would have witnessed no more than two or three acidophytic species on certain types of trees throughout the city. Today, not only is it possible to record the presence of epiphytic lichens on many kinds of trees for most of the city, but their luxuriance is such as to dominate large branches and trunks, and even in many of the relatively polluted areas they are to be found on the bases of trunks. As yet, as observed in hypertrophicated rural areas arising from agrochemicals and animal husbandry, nitrophytic lichens are rarely found on twigs in Hull. This recently developed flora is dominated by *Phaeophyscia orbicularis*, and, according to the level of amelioration and/or hypertrophication, by assemblages (in various levels of luxuriance and abundance) composed of one or more of the following: *Phaeophyscia orbicularis Physcia adscendens*, *P. tenella*, *Xanthoria candelaria*, *X. parietina* and *X. polycarpa*.

Certain lichen species known to be associated with particular environmental shifts are being targeted for detailed study at a national level, such as those indicative of hypertrophication; to this end, these species have received particular attention in the 2002 and 2006 surveys of Hull, the two distribution patterns, as exemplified by *Xanthoria polycarpa*, clearly demonstrating the impact of this factor, its over-riding effect being that of a pollutant. Other targeted species include those thought to be capable of monitoring global warming, such as *Flavoparmelia soredians*, and possibly *Candelaria concolor*. While neither taxon was recorded in 2002, both have been recorded in the 2006 survey from a few scattered localities; although both are nitrophytes, and thereby indicative of hypertrophication, there is some reason to believe from biogeographical studies at the national level that they also have the potential to monitor global warming. Biogeographically, the Hull records are of great significance since this is the first Yorkshire record of *Flavoparmelia soredians* and *Candelaria concolor* has not been recorded from the county for more than 100 years.

Hull is blessed with many tree-lined avenues and parks, comprising a variety of both mature and newly planted deciduous trees, which have proved ideal for environmental monitoring. The change in status of particular lichen species and assemblages, even over a 4-year period, has proved invaluable for this purpose. Furthermore, several parks contain lakes, usually heavily influenced by birds, with lakeside trees, particularly those with angled trunks that are conducive to lichen growth. Investigated parks with these features include Anlaby Park, East Park, Pearson's Park, Pickering Park and West Park; of these, East Park was less rewarding, but West Park, close to the city centre, proved to be exceptional, the presence of *Flavoparmelia caperata* and *Usnea subfloridana* on mature trees testifying to environmental amelioration. However, there appeared to be no improvement of the epiphytic lichen flora in Queens Gardens since 2002, although the more obvious saxicolous flora had undoubtedly responded to the maturation of man-made substrata surrounding water features over the intervening four years.

Roadside trees, as in the 2002 survey, continue to provide important habitats for lichens, but it has to be noted that roadways radiating from the city centre are not necessarily ideal for transect studies since the pollutants and dusts derived from vehicles are linear along its length, varying only according to traffic density. Lichen gradients along such roads can still be detected, as in the case of Boothferry Road moving westwards; however, as in 2002, there is a reversal in lichen improvement within 200-300 m of the city boundary, the influences from the west affecting this as yet to be determined. Close inspection of both young and old trees on roadsides proved most rewarding; even plane (and to a lesser extent sycamore) trees which continually shed their bark had biodiverse floras, reflecting the speed at which lichens were recolonizing the city; of particular interest in this respect was Laburnum Avenue where, for example, *Evernia prunastri*, *Flavoparmelia caperata*, *P. soredians*, *Hypogymnia physodes*, *H. tubulosa*, *Hypotrachyna revoluta*, *Ramalina farinacea* and numerous crustose

species have become established. Laburnum Avenue is one of several lichenologically interesting streets forming the Garden Village, a 'garden' housing development (1907-1913) commissioned by James Rickett and a present-day oasis for epiphytic lichens located only 2 km to the NE of the city centre. The enhanced lichen flora hereabouts is in direct contrast to the very low epiphytic diversity in otherwise hostile environments generated in neighbouring industrial, commercial and urban wastelands, the trunks of the mature trees in the grounds of Holderness House, for example, covered for the most part by an algal monoculture, punctuated occasionally by a single lichen *Lepraria incana* in bark crevices. Other avenues of lichenological importance similar to those found in the Garden Village are to be found throughout Hull, but mainly, as would be expected, in the suburbs, as illustrated by Inglemire Lane to the north of the University campus.

In the past, newly planted trees in urban areas were not conducive to the establishment of lichens. Rather interestingly, as a consequence of significant reductions in pollution levels, such trees are increasingly providing suitable substrata for the establishment of crustose species; one such new arrival is *Lecanora chlarotera*, a formerly widespread lichen which disappeared over large areas of England for more than 100 years as a consequence of atmospheric pollution. Although not seen during the 2002 survey of Hull, it is now present on the trunks of young trees as several sites throughout the city, including the new housing estate occupying the former dockland area (Bridge Road) where *L. carpinea* has also been recorded. More remarkably, two relatively young roadside trees on Liberty Lane close to the city centre each had a small thallus of *Flavoparmelia soredians*.

Golf courses provide refugia for interesting lichen floras. Sutton Park, the only golf course within Hull's boundary, is no exception, as witnessed in the 2002 survey; similarly, the one at Springfield Park, unfortunately just outside the city's boundary, has a relatively rich epiphytic lichen flora.

In the list of taxa recorded in the 2006 survey (see Appendix), information is provided on the changes in ecological and geographical status of epiphytic lichens over a four-year period. From this, it is obvious that the 2002 and 2006 surveys were undertaken at critical times in terms of Hull's environmental improvement programme. The 2002 survey, as revealed by zonal interpretation, showed that this progamme lagged behind that of many other urban areas in Britain, but the epiphytic floras encountered in the 2006 survey in suburban and parkland areas of Hull are comparable to those witnessed in similarly sized cities in Britain. Clearly, the provision of baseline studies and the establishment of procols for on-going monitoring, as recommended in the report on the previous survey (Seaward 2002), have paid dividends.

Lignum, particularly when impregnated with mineral dusts and/or nutrient enrichment, can provide a valuable substratum for the development of lichens in urban areas. Unfortunately, Hull appears to be deficient in this resource, with very few suitable old fences, bench seats, tree stumps, etc. However, such habitats are worthy of future lichenological investigation, particularly in terms of raising biodiversity counts for the city.

Although the 2002 and 2006 surveys focussed on epiphytic assemblages, attention was also paid to other substrata, particularly the saxicolous lichens of some of the city's older buildings and monuments (e.g. churches, churchyards, old brickwork) which were considered in terms of their lichenological as well as historical importance. Although the occasional interesting, and sometimes diverse, flora was encountered, saxicolous lichens were disappointing. In many cases, relatively modern architectural surfaces were more rewarding, and the local mosaics generated by a few poleophilic lichens, often with high cover values, ameliorated the drabness of heavily built-up areas. As regards older buildings and their environs, those situated in the city centre, such as Holy Trinity and St Mary Lowgate churches, supported very poor lichen floras. However, Sutton church, located in a suburban area still retaining some measure of a village milieu, was more rewarding in terms of the churchyard and surrounding wall, although the church itself, due to heavy pointing, etc., supported a very poor saxicolous flora. On the other hand, the church and churchyard of St Giles Marfleet, on the eastern periphery of the city, despite being located in a potentially

rural setting, was clearly subjected, on the basis of its lichen flora, to environmental degradation. Similarly, the churchyard at Sculcoates, admittedly straddling a busy road and situated in an industrial area (a large proportion of it closed down and replaced by urban wasteland), had a very poor lichen flora. When investigated in 2002, this churchyard was much more interesting, but in the space of four years, it has deteriorated beyond recognition due to neglect and vandalism, the gravestones for the most part now inaccessible due to overgrowth; rather interestingly, the relatively modern brick walls edging the graveyards on both sides of the road have provided a more agreeable substratum for the establishment of a lichen mosaic.

Cemeteries also provide valuable refugia for lichens, the substrata afforded by the various imported stones increasing biodiversity. The Northern, Western, Eastern and Hull City cemeteries were investigated, but the lichen floras in each of them were disappointingly low, a reasonably high biodiversity count being based mainly on the presence of one or two thalli of a particular species. It should be noted that there has been a noticeable decline in the lichen flora of the Western Cemetery since 2002, particularly its eastern end, which is now overgrown and densely shaded.

Hull's dockland development and replacement of former dockland areas with modern housing developments and estuary embankments are generally uninteresting from a lichenological point of view, although, as confirmed by lichen colonisation of newly planted trees, environmental quality has improved; unfortunately, the lichen flora of the resulting saxicolous habitats are still poor; however, with further imaginative architectural development, such as the water features in former docks, and maturity of estuary embankments (the lichen flora of which currently does not show a maritime influence), there is the potential for interesting assemblages to develop.

There are very few habitats suitable for terricolous lichens in Hull. Patches of semi-natural habitats were not observed, and lichens of urban wastelands, if indeed they had been encountered, would have been ephemeral and uninteresting in terms of evaluating the true nature of the city's lichen flora. Occasional *Cladonia* squamules were recorded in soils and mosses over stonework, but only rarely was it possible to identify them to species, such as *C. fimbriata* at Sutton churchyard. Although *Collema tenax* var. *ceranoides*, characteristically found on compacted soil of temporary pathways and car-parks, is most probably overlooked, it is also a representative of an ephemeral lichen flora to be found on urban wastelands that only persist for short periods of time.

Conclusions

It is clear from the 2002 and 2006 surveys that there have been significant changes in the lichen flora of Hull, not only in terms of an overall increase in biodiversity but also in the distribution and ecological strategy of many lichen species. Although these changes generally reflect environmental amelioration citywide, some areas are still in need of atmospheric improvement; furthermore, replacement lichen assemblages are often indicative of mineral dusts and nutrient enrichment, which in excessive amounts (hypertrophication) would need to be considered as a pollutant.

Although Hull has no Red Listed lichen species in need of conservation action, there are habitats supporting relatively rich and improving lichen floras which merit special consideration, such as mature trees in parks, on golf courses and on roadsides with wide verges. The conservation of existing trees and the planting of new ones, both of which support interesting and diverse epiphytic floras in ameliorating environments, are to be encouraged. Normally, lichen floras associated with some older buildings and monuments should be considered in terms of their lichenological as well as historical value. However, although it would appear that such associations are scarce in Hull, there are cases where the harshness of modern building work would clearly benefit from a mosaic of lichens, the growth of which would be encouraged by continued atmospheric amelioration.

To date, 97 taxa have been recorded from Hull (see Appendix), no less than 43 of which have been added to its lichen flora as a consequence of the 2006 survey (cf. Seaward 2004,

Appendix A). Epiphytic lichens, which have received particular attention in both surveys due to their value as environmental monitors, have increased from 30 to 50 taxa over the four-year period; similar increases have been noted for taxa growing on lignum. An increase in the number of taxa growing on brick, stone and other man-made substrata is mainly due to a greater interest in these habitats in the 2006 survey; however, it should be noted that a significant (and increasing) number of these taxa are also to be found on trees (particularly around their bases) and lignum, as a consequence of nutrient-enrichment (hypertrophication) and dust impregnation, a feature of present-day urban environments, as exemplified by Hull.

The value of an on-going programme of environmental monitoring, as recommended in the previous report (Seaward 2002), has paid dividends, since without the 2002 baseline survey, many of the above changes would have been difficult, or indeed impossible, to detect. However, there is no cause for complacency: one should not consider such undoubted improvements as rendering further action unnecessary, not only in terms of managing pollution but also in monitoring it. The complementary use of both physico-chemical devices and biological monitoring is strongly recommended for evaluating air quality and other environmental disturbances in the future.

ACKNOWLEDGEMENTS

The first author is most grateful to Dr Jon Capel (City Ecologist) for his continued interest in and support of this work, and to Kingston upon Hull City Council for commissioning this survey and report.

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APPENDIX

Checklist of lichens currently recorded within Hull city boundaries, together with notes of substrata, current frequency and change in status between 2002 and 2006. Species additional to those recorded in 2002 (i.e. listed in Seaward 2004, Appendix A) are prefixed by an asterisk (*).

Acarospora fuscata – brickwork & acid stone, occasional
* *Amandinea lecideina* – sandstone, rare
A. punctata – young and old tree trunks, occasional, but increasing

* *Anisomeridium polypori* – elm, rare
* *Arthonia lapidicola* – Zn-influenced brick wall coping, rare
* *Arthopyrenia punctiformis* – young tree twigs, rare
* *Aspicilia calcarea* – calcareous substrata, rare
* *A. contorta* – calcareous substrata, uncommon
* *Buellia aethalea* – on acid stone & wood seat, uncommon
Caloplaca citrina – calcareous substrata, locally frequent
* *C. crenulatella* – cement paving, uncommon
C. decipiens – calcareous dusty substrata, occasional, but increasing
C. flavescens – calcareous substrata, occasional
C. flavocitrina – calcareous substrata, including stone sea defences, locally frequent
C. holocarpa – calcareous substrata, occasional
C. saxicola – calcareous substrata, occasional
* *Candelaria concolor* – mature roadside trees, uncommon
Candelariella aurella – calcareous substrata, locally frequent
* *C. medians* – calcareous substratum, rare
C. reflexa – mature tree trunks, occasional
C. vitellina – acid stonework, mature trees & wooden steps, locally frequent
Catillaria chalybeia – granite chippings & tops of timber wave breakers, uncommon
* *Cladonia coniocraea* – corticolous, rare
* *C. fimbriata* – mosses over wall-top, rare
* *C. furcata* – wasteland soil, rare
* *Collema tenax* – cement wall-top, rare
* *C. tenax* var. *ceranoides* – compacted soil, rare, but overlooked
* *Diploicia canescens* – single thallus on mature tree, rare
Evernia prunastri – mature tree trunks, occasional, but increasing; rare on wood
Flavoparmelia caperata – mature tree trunks, occasional, but increasing
* *F. soredians* – young & mature tree trunks, uncommon, but increasing
Hypogymnia physodes – tree trunks, occasional, but increasing (some juvenile thalli probably *H. tubulosa*); rare on wood
* *Hypogymnia tubulosa* – tree trunks, occasional, but increasing; rare on wood
Hypotrachyna revoluta – mature tree trunks, uncommon, but increasing; rare on wood
Lecania erysibe- calcareous substrata, occasional
Lecanora albescens – calcareous substrata, locally frequent
L. campestris – calcareous & siliceous substrata, occasional
* *L. carpinea* – young tree trunks, rare
* *L. chlarotera* – young tree trunks, occasional, but widespread & increasing
* *L. confusa* – ash tree, rare
L. conizaeoides – tree trunks, timber & acid stonework, infrequent, declining
L. crenulata – calcareous substrata, occasional
L. dispersa – calcareous substrata, locally common; uncommon on wood & bases of trees where it is increasing
L. expallens – mature tree trunks, occasional, but widespread & increasing
L. muralis – stonework, cement, tree bases & woodwork, locally common & increasing
L. polytropa – acid stonework, occasional
* *L. saligna* – timber & woodwork, uncommon; probably increasing
* *L. symmicta* – cherry tree, rare
* *Lecidea fuscoatra* – acid stonework, rare
* *Lecidella elaeochroma* – young tree trunks & wood, uncommon
L. scabra – acid stonework & wood, occasional
L. stigmatea – calcareous stonework, locally frequent
Lepraria incana s.lat. (some material confirmed as s.str.) – tree trunks, acid stone & lignum, locally frequent, but declining
Melanelia fuliginosa ssp. *glabratula* – tree trunks & branches, uncommon

M. subaurifera – tree trunks & branches, woodwork, locally frequent, widespread & increasing
* *Micarea nitchkeana* – alder, rare
* *M. prasina* – tree (?oak), rare
Parmelia sulcata – tree trunks, locally frequent, widespread & increasing
Phaeophyscia nigricans – calcareous substrata, occasional; uncommon on tree trunks
P. orbicularis – tree trunks, timber, stonework, etc., very common & increasing
Phlyctis argena – mature tree trunks, rare
Physcia adscendens – trunks, very common & increasing; rarely on calcareous substrata
P. caesia – tree trunks, locally frequent & increasing; occasional on brick & other man-made substrata
P. dubia – tree trunk bases, uncommon
P. tenella – tree trunks, locally frequent & increasing
Physconia grisea – tree trunks, occasional, but increasing
* *Placynthiella icmalea* – tree trunks, lignum & acid stonework, uncommon
Porpidia soredizodes – acid stonework, rare
P. tuberculosa – acid stonework, infrequent
* *Psilolechia leprosa* – Zn-influenced stonework, rare
P. lucida – acid stonework, occasional
* *Punctelia subrudecta* – mature tree trunks, occasional; sometimes difficult to separate from following species; both species probably increasing
P. ulophylla – mature tree trunks, uncommon
Ramalina farinacea – tree trunks & branches, occasional, widespread & increasing; rare on wood
* *R.* cf. *fastigiata* – on tree trunk, rare
* *R. fraxinea* – on tree trunks, rare
* *Rhizocarpon reductum* – acid stone, rare
Rinodina gennarii – stonework & brickwork, infrequent; rare on woodwork & trees
* *Sarcogyne regularis* – calcareous substrata, rare
Scoliciosporum chlorococcum – tree trunk bases & branches, occasional; probably increasing (or overlooked)
S. umbrinum – calcareous substrata, occasional
* *Stereocaulon vesuvianum* var. *symphycheilioides* – Zn-influenced brick wall coping, rare
Trapelia coarctata – acid stonework, infrequent
* *T. placodioides* – shaded sandstone, rare
* *Trapeliopsis flexuosa* – lignum, rare
* *Usnea subfloridana* – mature tree trunks, rare
* *Verrucaria baldensis* – calcareous substrata, rare
* *V. hochstetteri* – calcareous substrata, rare
V. macrostoma f. *furfuracea* – calcareous substrata, occasional
V. muralis – calcareous substrata, occasional, but overlooked
V. nigrescens – stonework, occasional, but overlooked
* *V.* cf. *viridula* – churchyard memorial, rare
* *Vezdaea leprosa* – Zn-influenced brick wall coping, rare
Xanthoria candelaria – tree trunks, locally frequent & increasing
* *X. elegans* – cement coping, rare
X. parietina – tree trunks & twigs, stonework, etc., common & increasing
X. polycarpa – tree trunks and twigs, widespread, locally frequent, increasing; rare on acid stone

BOOK REVIEW

Silent Fields. The long decline of a nation's wildlife by **Roger Lovegrove.** Pp. 404, with 29 b/w figures, plus 40 line illustrations of individual species by **Ross Lovegrove**. University Press, Oxford. 2007. £25, hardback.

As the author of this book remarks, it is a sad indictment of the past abuse of wildlife in Britain that one of the priorities for conservation has to be the recovery of species that were deliberately eliminated in previous centuries. He charts the history of destruction of terrestrial wildlife from the time of the Tudor Vermin Acts, of which the first was introduced in 1532, to the present. There were even earlier Acts in Scotland but their effects are little known, whereas in England and Wales Churchwardens' Accounts of payment for 'vermin' provide a rich, if erratic, source of information that has been painstakingly exploited by the author who has examined almost 1600 such lists from all the ancient counties of England and Wales. The earliest perused was for 1527, from Wing in Buckinghamshire: the earliest for Yorkshire, of which the sample of 91 is the largest for any county, is for Masham in 1542, whose record continues to 1677.

While it is easy, from the comfort of a well-fed present, to be critical of legislation that later led to the slaughter of vast numbers of birds and mammals, the initial intention was to protect the grain harvest, and successive Acts in Elizabethan times were passed in a period of severe winters, bad harvests and even famine – though the victims included a motley assortment of species that could hardly be accused of eating grain. Later slaughter was also often based on ignorance, and eventually carried out in the interest of game preservation. There were over 23,000 gamekeepers in 1910, "whose primary function was to remove predators". These onslaughts, and even earlier killing for the fur trade, went hand in hand with vast changes in the countryside, some of which had adverse effects on various species, and had much earlier contributed to the elimination of the Brown Bear, Wolf, Wild Boar, Beaver, and others. The introduction of alien species including Rabbit, Grey Squirrel, Brown Rat and American Mink, and, it might have been mentioned, the Pheasant, have been added complications. All these things are considered in this compendium of information, which includes a long species by species account of the victims. Although often a recital of facts, these are well presented and interest is sustained, though the tale – or toll – of slaughter is horrendous. Estate records, where available, present some of the most appalling figures. Others may share my surprise that 5,904 Hedgehogs were killed at Sandringham between 1938 and 1950, and 5,623 at Holkam between 1953 and 1959. Since then road kill has taken its toll on this unfortunate insectivore and the now diminishing number of flattened carcasses simply reflects a drastic decline in numbers. Earlier records of slaughter on Scottish estates are even worse and cover a multitude of species – though the oft-cited figures for Glengarry in the early 19th century need to be taken with a pinch of salt.

As the author says, this persecution was formerly carried out "untrammelled by concerns for morals, public attitudes, legal constraints, or thoughts of extinction". Times change, and all these factors are now supposedly taken into account – yet 85% of those convicted of raptor persecution since 1985 had a game interest, and most were gamekeepers. In general the public is ignorant of the scale of illegal persecution of wildlife that is still carried out in the name of vermin control. The author is no unthinking 'animal lover' and appreciates the need for intervention at times. How many opponents are there to the control of the Brown Rat? What, he rightly asks, is how can we manage our wildlife today as part of the rural fabric and economy? With increasing populations of the Buzzard, the bringing back from the brink of extinction of the now flourishing Peregrine Falcon, and successful re-introductions of the Sea Eagle and Red Kite, to point the way, we are making progress. Read this book in order to be well informed about the complexities of the biology and vested interests involved, and thereby to be in a position to ensure that further progress can be made.

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NEWLY DISCOVERED WRITINGS OF A PARSON-NATURALIST: THE JOURNALISM OF THE REVD FRANCIS LINLEY BLATHWAYT (1875-1953)

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Introduction

The Revd F.L. Blathwayt was one of that quintessential Victorian/Edwardian English breed, described by Armstrong (2000), the parson-naturalist. Yet Blathwayt's name is not listed in Armstrong's book and until recently little was known about him outside, perhaps, the Dorset and Somerset areas where he spent his later years. This is odd, because Blathwayt's work on the distribution of British birds has been cited in appropriate studies from the 1890s right up to the present time (e.g. Brown & Grice, 2005).

Following the publication of Blathwayt's biography (Kerry, 2005), members of the Blathwayt family made additional documents available to the author from which he was able to augment the picture of the man established from sources garnered elsewhere. This article attempts to do three things which it is hoped will inform and engage the reader. First, there is a brief outline of Blathwayt's life to place him in various historical and ornithological contexts. Second, a brief survey of his writing (both personal diaries and published works) provides a literary context. Third, the discovery of a new genre of published newspaper items by Blathwayt is used both to enlarge our understanding of the man and to expand our view of him as an author on natural history topics. Of this genre, five confirmed items have so far come to light; and while two were mentioned in a review of Blathwayt's year as President of the Lincolnshire Naturalists' Union (Kerry, 2006), it is thought that this is the first time the other three have been discussed in print since their publication and the first time all five have been used together to explore one of Blathwayt's writing styles.

The Life and Birding of Francis Blathwayt

Francis Linley Blathwayt, related to the aristocratic Blathwayts of Dyrham Park, Gloucestershire, was born in India in 1875 to a civil servant father, Charles, and mother, Alice (Kenworthy-Browne, 1999). His middle name was taken from his father's brother who was also serving as a lieutenant-colonel in the Indian army. Correspondence shows Alice to have been a very active and feisty lady, and so it was doubly tragic when she died only three years after Francis' birth.

Francis, the eldest of three brothers, was repatriated to live with an aunt on the south coast. We meet him again at Malvern College, then only recently opened but with a growing tradition in natural history. He went on to Hertford College, Oxford for his degree (Indian woods and forests), but did not return to India: the Church of England beckoned, and in 1900 (Fig. 1), after attending Lincoln Theological College, he took orders and was made curate of St Swithin's church in Lincoln's city centre.

When, in 1904, Blathwayt moved to a second curacy at All Saints, Monks Road, half a mile to the east of St Swithin's, he would have witnessed one of Lincoln's blackest hours: a typhoid epidemic. Lincoln was at that time far from today's tourist city, with marshy slums, poor and unhygienic conditions stretching along the river into the dirty industrial heart of the city (Kerry, 2005). It was also a period of social and religious turmoil in the city.

Evidence gained from local church records shows the young Francis as a diligent, involved and well-liked priest. Nevertheless, he was not afraid to take time out to follow his first love and driving force: natural history, especially bird watching. His approach was very modern. He adopted a local 'patch' (Boultham Mere), he used powerful field glasses rather than a gun, he made diligent notes, he sought ancient written records and the 'living

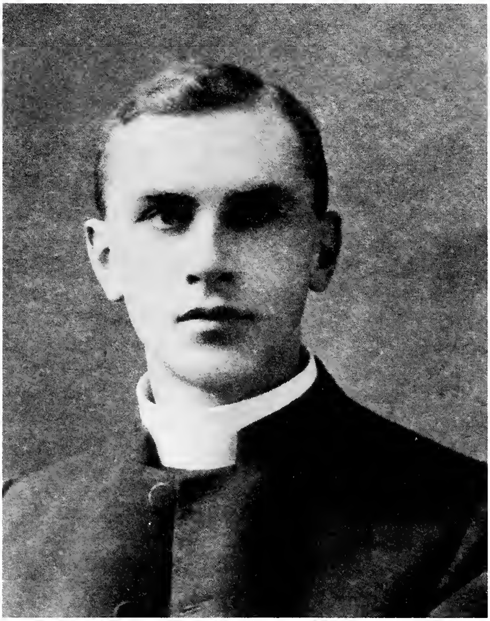

FIGURE 1
Revd F. L. Blathwayt c.1900 (photo courtesy of Lucy Blathwayt).

voice' of woodsmen and keepers, and he frequented the taxidermists' shops to monitor what had been recently captured and sold.

Piece by diligent piece, Blathwayt added to his knowledge, keeping the records from 1893 to 1953 in ledger-like diaries, with records on the right-hand pages and notes on the left. When he obtained his first independent living, the parish of Doddington, six miles from the city, he became admirably placed to pursue his birding, for Doddington was then surrounded by woodland which stretched to neighbouring Skellingthorpe; the Hartsholme estate was a short bicycle ride away, and the wonderful Scotton Common and Twigmoor estate were also accessible. These areas now became the Blathwayt haunts, though there were frequent trips around the country, particularly to Devon and Somerset.

Francis Blathwayt's sojourn in rural Doddington is described in some detail in Kerry (2005). This was the first rural parish of just three which occupied his entire life and ministry to the then comparatively late age of seventy-eight. He moved from Doddington at the end of 1916 to Melbury Osmund in Dorset, perhaps head-hunted by the local squire, the Earl of Ilchester, for his birding expertise: the Ilchester family had established the Abbotsbury Swannery. In 1929 he made his final move to the parish church in the village nestling beside his ancestral home in Dyrham.

During this time he had been responsible for numerous bird-related publications (see below), but also for the amazing achievement of establishing modern and reliable county bird lists for Lincolnshire, Somerset and Dorset.

Blathwayt's Natural History Writing: An outline

All the Blathwayt writings which had then been discovered are listed in Kerry (2005: 196-199). Here, it is the intention to discuss briefly the nature of these writings in order to set the scene for a quite different genre to be identified in the next section.

Diaries

The earliest Blathwayt writings consisted of unpublished diary entries, and these entries continued through 22 volumes over the period 1893-1953. The material here has a distinctive and changing character. The earliest entries are often immensely detailed. Right-hand pages are reserved for bird records, left-hand for other natural history subjects and for notes and observations, sometimes passages copied in quotes from books or articles. The writing is often tiny, requiring outstanding eye-sight as well as fine motor co-ordination. These features change over time, to more straggling and larger script, often hard to decipher. The left-hand pages are often about moth and butterfly species, and use the Latin names.

While Francis retained a life-long interest in other forms of wildlife, the diaries become almost exclusively bird-related. They also have a quality that suggests he expected them to be in some sense public documents. He uses the left-hand pages to make addenda or corrections to entries, even to query his first judgements in some cases; he marks some passages, often in blue crayon, and a scrutiny of these shows they were the passages that recur in published work. The published work became increasingly significant, running to 154 items listed in Kerry (2005), plus several additional ones (see below), and falls to three main categories: articles, reports and notes.

Articles

Under this heading are included journal articles for *The Zoologist*, the *Transactions of the Lincolnshire Naturalists' Union*, and the *Proceedings of the Dorset Natural History and Archaeological Society*. Here, too, are a pamphlet to raise money for the Lincoln City and County Museum and a chapter for the *Victoria County History of Somerset*. Since writing Kerry (2005), this list has been extended by the discovery of five more items from *The Zoologist* (Blathwayt, 1904a, b, c, & d; 1906), and by a contribution he made to a book by Mullens *et al*. (Blathwayt, 1915). In all this represents a total of 25 items.

As well as being tailored in style to fit the individual journals or purposes, the nature of these articles and chapters shows Blathwayt relating his style to the subject-matter. An item on the birds of Lundy contains useful tourist advice, an early piece about the roseate tern *Sterna dougallii* (the bird that fired his imagination most) records his first ever viewing of a skin of this species in a collection rather than a real sighting, the pamphlet for the museum is a tour around the cases of specimens. However, the chapter in the *Victoria County History* is the result of several years of research to produce the County List; it is backed by literature, is evidence-based and critical in approach.

The tantalising element in these articles is that, from time to time, there are glimpses of a writing style that combines the accuracy of the detached scientist and observer with the insight and feeling of a literary artist. Sometimes these passages closely mirror a diary entry which is in more reflective mode. A good example of this is his description of shelducks *Tadorna tadorna* on Scotton Common:

> In April three or four pairs of sheld-ducks [*sic*] usually appear on the ponds and much chattering and squabbling takes place. Not more than one or perhaps two pairs remain to breed. The eggs are laid at the end of a burrow in the sand among the heather, and the young are hatched out about the middle of June. On June 22nd, 1903, I saw a pair with four ducklings of a few days old on one of the ponds. These latter were exceedingly active little creatures, diving very cleverly and staying a long time beneath the water. I caught one of them with great difficulty, and on being released it immediately dived, and I could watch it for some time travelling at a good pace not far below the surface, and paddling vigorously with its webbed feet. The parent birds showed great anxiety until I moved away, the female being particularly demonstrative and flying close up to me while I was standing in the water.

Such passages have an immediacy and charm, combined with a scientific accuracy,

reminiscent of Huxley's (1930: 67-73) famous description of the great crested grebe *Podiceps cristatus*. Early diary entries sometimes serve as the source for such writing; later this kind of prose disappears from the diary. This more aesthetic approach does not re-appear in the following categories of published work, and for some time it remained a mystery as to why this genre had disappeared from Francis' literary métier, or where it was secreted.

Reports

Of a far more prosaic nature, inevitably, are the many reports which Blathwayt wrote on birds and other natural history topics. The very volume of these is impressive:

8 Reports on the county's birds for the Lincolnshire Naturalists' Union (published annually in *Transactions*): 1911-1918

31 Reports on the county's birds in the *Proceedings of the Dorset Natural History and Archaeological Society* (DNHAS): 1918-1933

16 Phenological Reports on first appearances for DNHAS: 1918-1933

30 Reports on the county's birds for the *Somerset Archaeological and Natural History Society*: 1920-1949

10 Reports on Natural History for DNHAS *Proceedings*: 1934-1943

These items represent 95 known annual reports on birds and other wildlife topics; an impressive output. They are all very much in the 'listing' style for which Blathwayt inevitably became most well known is his own day; for he was a work-horse, willing to collect data supplied by others to augment his own, and then to synthesise and systematise it, and he loved receiving reports from other observers (often on postcards, a few of which are still extant).

Notes

Blathwayt was also a prolific writer of Notes for *British Birds*. In Kerry (2005), 40 such Notes are itemised, some only a few lines long, others a page or more. These Notes fitted well with the Reports, and many refer to sightings notified to him as well as his own observations later included in the county reports. These items are very carefully observed and recorded. They include his great personal triumph and joy: a note of the proven breeding for the first time of the roseate tern in Dorset, on the Chesil Beach (Blathwayt. 1921).

Summary

Thus, the Blathwayt corpus is extensive, and varied. There is much that delineates a careful scientist going about meticulous recording work. However, now and again that precision is extended and made more accessible by a more literary and aesthetic approach, not far removed from the very best in natural history writing. In researching his work for Kerry (2005), the author was surprised by how few examples of this genre were published; but the documents subsequently loaned to him by his grand-daughter unearthed a surprising treasure-trove that is yet to be fully explored. In what follows an attempt is made to share with the reader the first as yet faltering steps down this road.

Blathwayt as a Journalist: New light on a much-published writer

Among the Blathwayt documents loaned to me were a number of yellowed and faded newspaper cuttings. At first they appeared unremarkable: Francis often clipped fragments of newspapers that were relevant to his themes and put them between the pages of his

diaries. Further, some of them did not contain birding themes, which were the major focus of my searches. A few were, however, attributed to Blathwayt himself. Others had been annotated with publication dates. From this early discovery two small groups of cuttings emerged, both as yet in the early stages of research, and only those with birding themes are discussed below. The first group was culled from local newspapers; the columns show him writing in a quite different way from much of his other published work, in fact as a journalist. In the sections that follow the intention is to illustrate this change of style.

1911 'Pageant of early summer' *The Nottingham Guardian*
In this article, source and date (6 June) added in Blathwayt's own hand, the writer rehearses the wonders of the spring season:

> April, indeed, begins to deck the meadows in their gayer garb, but May and June work more rapidly, and, as the pageant passes by, show us the countryside in ever-varying dress. The daisies and cowslips give place to the cuckoo flowers and the yellow sheets of dandelions . . . Nature is lavish with her yellows and soon the flame of the dandelions gives way to the enamelled gold of buttercups. A meadow at the end of May, set ablaze by the rays of the sinking sun striking a sheet of golden buttercups, is a treat which Nature offers us freely at the very gates of our largest towns . . .

And again:

> . . . The woods and hedgerows play their part in this glorious procession. April leads past the delicate wood anemones, and the massed pale yellow primroses . . . In May a sort of blue mist seems to hang over the ground under the fast expanding leaves in the coppice . . . the wild hyacinth or 'bluebell' . . . then thick and fast come bugles, wood forget-me-nots, and speedwells, adding to the woodland blues and striving to make that colour the predominant one among the flowers.

Having laid the groundwork of spring's emergence, the piece moves on to Blathwayt's favoured birds:

> By the middle of May most of the summer birds have mated, and are busy with their nests. The warblers fill the woodlands with song, and on a bright warm morning the blended notes of a dozen different species form a beautiful harmony. The plaintiff chime of the willow wren, the ecstasy of the tree pipit as he shoots into the air and descends like a parachute, singing the while, to his perch; the joyous ring of the blackcap's song, and the bubbling warble of the garden warbler, each in turn strike the ear of the listener with familiar recognition year after year, and make him wonder how the little wanderers have been faring during their absence, and how they have found their way home.

Here, too, are mentions of Blathwayt's forays into Yorkshire:

> . . . Happy is the bird lover who can visit the birds' citadels and camps on sea cliffs and shores, by the roar of the waves. There is no space left to write of the thousands of puffins and guillemots I have seen on the chalk cliffs near Flamborough Head . . . these scenes belong more properly to the close of June . . .

As one reads this article, a substantial piece of *c*. 5000 words not one of today's 200-word journalistic offerings, several impressions are gained. First, here is an author still striving for the aesthetic turn of phrase to convert a vision into a word picture [cf. for example, the slightly awkward 'a sort of blue mist' or the tautologous 'bubbling warble of the garden warbler']. Second, he is conscious of a wider purpose than to delight: the wish to educate and even to record:

> Last of all the summer migrants comes the spotted flycatcher. He seems more dependent on flying insect life for a living than many of the other soft-billed birds, which feed also on grubs and crawling insects, and perhaps that is the reason he comes so late. Anyhow, he is seldom seen in the Midlands before the 11th May . . .

This column, written from Doddington Rectory, not for the Lincolnshire press but for a paper over the border in Nottinghamshire, may have augmented the family income by a guinea or two. It certainly seems to be an extension of the Blathwayt literary armoury, and one he was to repeat as occasion demanded. Elements of this kind of writing had been in evidence in the diaries, but not in the bulk of the published work.

1912 'Migration of birds – the great autumn migration on the Lincolnshire coast' *Nottingham Guardian*
This column (*c*. 4000 words) is firmly attributed to 'F.L.Blathwayt' and is again sourced and dated in his own hand. It is more educational and less concerned with the aesthetic. Again it shows a knowledge of, if not a familiarity with, areas beyond his (at that time) base of Lincolnshire:

> It is possible that owing to their more prominent positions, the Yorkshire Spurn Head and the coast of Norfolk, near Wells, are more frequently visited by rare continental birds of passage than the coast of Lincolnshire; but the north-east coast of the latter county has been well watched by some very energetic and capable naturalists . . .

Yet there are, as well as these speculations, some quite well-crafted passages:

> . . . it is along the sea coasts of our islands that the great tide of autumnal migration chiefly flows, and at times this is so pronounced that a vast stream of birds may be moving southward along the Lincolnshire coast without a single sign of movement being noticeable to an observer a mile or two from the sea . . .
>
> What is this great autumn movement of birds? What is the nature of this impulse, which to a greater or lesser extent quickens in all birds, and sets them on the move at the fall of the year? . . . There is little or no unnecessary delay on the vernal migration . . . The autumn migration is, on the other hand, a more leisurely return to winter quarters.

So it is that Blathwayt ventures into journalism and begins to hone that skill. As we shall see, it is one to which he returns. As yet, it has not been possible to verify the extent of his work for local papers during his Lincolnshire years, but one thing is certain: he definitely began, even then, to seek a wider market for his writing.

1914 'Brean Down and its ravens' *Bristol Times and Mirror*
Thus it is that the third piece of Blathwayt's journalistic work on birds, while written in the Lincolnshire period (1900-1916), is to be found in a Bristol newspaper. It is credited to Francis, and he has added the publication date (29 May, 1914) and the source in his own hand on the cutting. His spur or inspiration for the piece is the publication by the Royal Society for the Protection of Birds of a pamphlet about the area, and Blathwayt recalls his own episodes of watching at a spot 'with which I was once very familiar'. He dates his familiarity as being in the decade beginning 1897. The article is substantial (*c*. 5000 words), and contains a 'confession' about youthful forays with his brothers trying to collect eggs of ravens *Corvus corax* (a practice he has long abandoned and now frowns upon). The foray is described in narrative form:

> But stay, there is still hope! There may be an addled egg. The climber is evidently exploring the nest, as no signal to 'haul away' has yet been given. At length it comes,

> but why won't the climber relieve our suspense and tell us whether or not he has found an egg? Not a word will he say in answer to our eager shouts, and even when his head appears above the cliffs he is still speechless. And not until he is safely seated on the short, crisp turf is the cause of his silence explained. Out of his mouth he carefully disgorges a large, slightly streaked and speckled pale green egg, afterwards found to be addled, and which, unlike the kestrel's egg of *Tom Brown's Schooldays,* was luckily unbroken. Our hopes and ambitions of the day satisfied, and the ravens we loved unharmed. Glorious are those young, eager, irresponsible days: perhaps they never quite come again!

This article is an altogether exuberant, charming and nostalgic piece where the flow of the narrative has subsumed the desire to instruct and record except in the detail of the descriptions.

The trio of local newspaper contributions cited above shows us a different side to Blathwayt, a more exuberant and aesthetic side, than most of his other work evinces (though his Mansel-Pleydell prize-winning paper later exhibits this approach; Blathwayt, 1917). It remains to be investigated whether other examples of Francis' journalism for local newspapers can still be tracked down. What is clear, however, is that this was not the limit of his ambition.

Among the documents loaned by the family, there was one cutting stamped as a corrected proof. It was credited simply as 'from a correspondent'. Francis had dated it (12 July, 1933) and sourced it. It was about red kites *Milvus milvus*. An entry in the diaries for early July told precisely the same story in closely similar language. Among some family photographs a picture emerged of a little old car and caravan among Welsh hills, labelled Tal-y-llyn and dated July 1933 (Fig. 2). The whole incident described in the cutting was thus verified and laid bare. The cutting was from *The Times*, leaving only the frustration of trying to track down other possible items written by Blathwayt simply as 'a correspondent' for what must be considered to be the highest pinnacle of publication for the aspiring journalist.

FIGURE 2
Blathwayt's caravan, Wales, July 1933.

1933 'The last home of the kite' *The Times*
From the evidence it is easily possible to reconstruct the story of the Blathwayt family's visit to Wales, their sojourn on the hillside in the little two-tone caravan, the trepidation with which they edged as far as possible up the mountain roads and tracks in the soft-top

car, and the joy with which they tracked down and viewed the kites – interestingly, in a haunt still occupied by this species (Cocker & Mabey, 2005: 114-115). Francis recalls the area thus:

> Here is the gate to the last haunt of the kite. The gentle ascent up the valley on foot is full of interest. Little trout can be seen in the clear pale-amber water below; grey wagtails, those sylphs of the mountain stream, flit from stone to stone; and numbers of large dark green fritillaries, looking very bright in the brilliant sunshine of the early July heat-wave, hurry around . . . ferns creep from cracks in the rocks . . . the dancing waters are studded with pink and blue jewels, the ivy-leaved bell-flowers and the bog pimpernels.

But it is the kite that he has come to see:

> There, above the tree tops, a splendid bird, with a few easy beats of his wings, mounts to a commanding height. Now follows a grand display of aerial mastery. Round and round he goes on widespread, motionless pinions, gliding rather than flying, ascending, falling, swinging round in curves and circles or sailing across the valley.

He has left his egg-collecting days far behind with the follies of youth, and despite the sheer delight at the vision of the kite, intentions now are strict and honourable:

> Presently the hen bird appears from the midst of the oaks and, with slowly moving wings, flies round below her mate until she, too, has gained mastery of the air, and joins him in 'the glide'. The nest is near the top of an oak in the midst of the wood, and by getting up the slope above we can look down into it and see two young birds, fully feathered, and evidently almost ready to fly. It is better not to linger here. Quietly we slip away, casting many a wondering glance at the wheeling birds above the sun-lit oaks.

For birders, it will not be hard to imagine the tingling excitement Blathwayt felt on returning to his caravan that evening. At the moment of Blathwayt's observations, it is estimated, there were no more than ten pairs of kites in Wales. Even this, it seems, does not tell the whole story. Carter's (2001) excellent book records (p. 20) that research has suggested that all kites in Wales at that low point were descended from just one female – 'as close as it is possible to get to becoming extinct'.

So Blathwayt has made progress into journalism not just locally but nationally, albeit anonymously. The column contains all the features of journalistic writing: a good story, a little revelation, a touch of secrecy, fine descriptions, immediacy of style. However, this may not have been his very first column published in *The Times*.

Among the family documents was another *Times* piece. It was clipped so as to preserve the banner section with the date; but the newspaper's name was missing and Blathwayt has hand-written it on. It bears all the hall-marks of an item collected and stored because of ownership, and one can feel reasonably secure in the assumption that it is indeed a Blathwayt piece, though again attributed to 'A Correspondent'. It pre-dates the column on kites by two years. If these deductions are correct, then this is one of the most beautifully-written pieces of all the journalism of Francis Blathwayt.

1931 'The Dawn Chorus: a thanksgiving for existence' *The Times* (20 May)
Anyone who has clambered, bleary-eyed from his or her bed, before first light in mid-summer will empathise from the first phrases of this delightful column and warm, despite the morning chill, to these descriptions:

> There is, in the very early morning before dawn, a feeling of intent watchfulness and suspended activity, like that of an animal about to spring; the passive surrender of night

> is gone, and everything waits in silent preparation for the day. This brooding silence is suddenly broken by the crowing of a cock, the signal for the departure for the spirits of darkness; it is also the herald for the kingdom of the day. Its crowing will remain unchallenged for perhaps a quarter of an hour, except for the occasional screech of a little owl and the distant, drowsy rasp of a corncrake, which sounds as if it were drawing its claws over the teeth of a comb.

This passage is powerfully reminiscent of that superbly constructed (but, in adaptations, often-omitted) chapter 'The Piper at the Gates of Dawn' in Kenneth Grahame's *Wind in the Willows* (1908). It is perhaps slightly amusing, if a touch jarring, to discover that it was F.L. Blathwayt, and not the modern lyricist Elton John, who used a now famous phrase:

> The chorus begins to dwindle and subside, the different notes going out like candles in the wind, until in scarcely more than an hour from the time when it began there is nothing left of its former grandeur . . .

Conclusions

The investigation into the life and work of Francis Blathwayt is on-going. It is possible that three more articles written by 'A Correspondent' for *The Times,* and which appear in the family documents, are his. Two are on birding themes (the doubt about them is that they cannot be corroborated in any way from the diaries – there are no records of his visiting the areas described), and one which is about life in the local vicarage (not his usual *locus* for literary effort). Furthermore, there is scope for far more investigation into archive sources to examine whether further examples of local journalism exist in the Midlands, in the South West, or indeed further afield.

Nonetheless, these limited discoveries have been instructive and have provided useful clues and insights: they are thus worth sharing. The items reviewed throw new light onto Blathwayt's writing and on his ability to write in a variety of styles. They show him capable not just of precise listing and recording, but of a wonderful and descriptive empathy with the subject matter as well as a concern to educate the reader. If there is a recoverable corpus of journalism, of which these articles are just the ice-berg tip, then one may have to re-assess the contribution of Blathwayt to ornithological literature.

One thing is sure: if the glimpses we have of this 'other' Blathwayt, removed from the somewhat turgid 'lister' and pedantic seeker after minute accuracy (entirely laudable though this is as a scientific intention) were to be augmented, then one might have to re-evaluate the man closer to his declared hero, Gilbert White. He might, in this event, be promoted to the first rank of naturalists, a position that his own gentle humility would never have sought.

Acknowledgements

I would like to record my thanks to the Blathwayt family for their generous access to archive documents, to Carole Showell, Librarian, British Trust for Ornithology, for finding obscure sources, to Professor Mark Seaward for checking the archives of *The Naturalist*, and to Dr Carolle Kerry for her companionship and assistance in exploring the locations integral to the birding life of Francis Blathwayt.

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BOOK REVIEW

Of Roseates and Rectories. The birding biography of the Revd Francis Linley Blathwayt by **Trevor Kelly**. Pp. 208, incl. 3 b/w photographs; paperback. Pintail Publications / Tucann Books, Lincoln. 2005. £12.50 (incl. p & p) from TK Consultancy (Lincoln) Ltd, 15 Lady Bower Close, North Hykeham, Lincoln LN6 8EX.

For almost three centuries, members of the clergy formed the backbone of natural history recording in Britain, much of their extensive fieldwork preserved for posterity in a wide variety of published sources. Tracking down these sources and biographical details of such naturalists is both challenging and rewarding – their notebooks and collections, which provide a wealth of information on our changing fauna and flora, often neglected or indeed binned in an age which over-relies on the computer. Such cultural heritage deserves better treatment and we should be thankful that there are biographers like Trevor Kelly who are devoted to documenting in some considerable detail the important role played by earlier naturalists, many of whom are undoubtedly worthy of wider recognition.

Once such parson-naturalist is Francis Linley Blathwayt (1875-1953), whose birding diary and published articles spanned 50 years. His ornithological activities ran parallel with the three rectorships he held in the parishes of Doddington (Lincolnshire), Melbury (Dorset) and Dyrham (Gloucestershire); however, this book concentrates on his time in Lincolnshire, 1900-1918, and birding knowledge gained achieved through detailed observation and extensive survey work covered on foot and bicycle. In 1914, Blathwayt published a complete bird list for Lincolnshire (as he did for Dorset and Somerset) and was elected as President of the Lincolnshire Naturalists' Union in 1918; he chose as his address 'The birds of Lincolnshire, past, present and future', an insightful study stressing the need for conserving our diminishing natural history heritage, an innovative approach which was not to be addressed for more than half a century.

Trevor Kelly is to be congratulated on his portrayal of Blathwayt and for providing such an extensive and detailed textual apparatus of notes and references; with such a wealth of information, the lack of an index comes as a disappointment. Further information that has recently come to light is to be found in this issue of *The Naturalist* (pp. 51-60). Not only ornithologists, but those interested in the history of natural history in general will find this book of considerable interest.

MRDS

REPORT OF YORKSHIRE NATURALISTS' UNION BRYOLOGICAL SECTION: 2004-2006

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Excursions

Hardcastle Crags (VC 63), 8 May 2004 (TLB)

Hardcastle Crags has long been known as one of the most important bryophyte sites in the southern Pennines, and the spring excursion in 2004 provided an opportunity to check the status of some of the noteworthy species recorded there. We entered the valley from the Greenwood Lee car park, and spent most of the day in a circular walk northwards along the Hebden Water and then through the woods on the east bank. Almost immediately as we descended the steep slopes into the valley we found good quantities of *Scapania umbrosa* on moist rocks and *Dicranodontium denudatum* on wood. The rocky woodland here is rather rich in liverworts, and among the species we noted on the grit rocks were *Barbilophozia attenuata*, *B. atlantica*, *Marsupella emarginata*, *Scapania nemorea*, *S. gracilis* and in moist recesses *Saccogyna viticulosa*. The mosses included *Tetrodontium brownianum*, *Blindia acuta*, *Seligeria recurvata*, *Amphidium mougeotii*, *Hookeria lucens* and *Heterocladium heteropterum*.

One of our objectives was to seek out one of two known populations in the valley of *Jubula hutchinsiae*, a strongly oceanic liverwort of wet rocks. We eventually located it on a dripping bank on the west side of the stream. However it was in smaller quantity than I remember seeing it here in the 1980s. Nearby an unexpected find was *Riccardia palmata* growing with *Nowellia curvifolia* on a rotten log by a runnel. It is a new vice-county record and it seems likely that it is a new arrival in the area. It is hard to believe that such a distinctive species could have been missed by earlier bryologists in such a well-worked locality. A patch of *Rhytidiadelphus loreus* was on the ground in the woodland here.

Though not unexpected, it was still a pleasure to see a number of epiphytic bryophytes now recolonising the trees, including *Metzgeria fruticulosa* and *Ulota bruchii*. Only two decades ago these species were unknown in the district because of high levels of atmospheric pollutants, although *Ulota* species had been known in the early nineteenth century.

Our circuit through the woods took us to the locality for the liverwort *Lepidozia cupressina*, another oceanic species here at its sole site in the South Pennines. It was eventually refound on the single boulder where it occurs on a bank under oak trees. Nearby there are some small outcrops of base-rich grit rock supporting some calcicoles otherwise unknown in the district. Most notable is *Cololejeunea calcarea*, a characteristic species of the mountain limestone, here in its only vice-county site. *Tortella tortuosa*, *Zygodon viridissimus* var. *stirtonii* and *Neckera crispa* are among the other species that occur on these small rock outcrops.

On our return to the Greenwood Lee path we did not have time to walk downstream to visit the second site in the valley for *Jubula*. Indeed our visit covered only a small part of this interesting valley, but it was encouraging to find that many of the notable species are still holding their ground.

102 species were recorded in total.

Grosmont and East Arncliffe Woods (VC 62), 16 October 2004 (JMB)

The party of four met in Grosmont in the Esk Valley. The purpose of the visit was an attempt to refind *Orthotrichum sprucei*, seen by Tom Blockeel by the River Esk in 1978. Recent heavy rain had put the river in spate and, as the moss grows mainly on tree roots in

the flood zone, it was not refound. However *O. rivulare*, a related species with a similar ecology, was found near the base of several trees. There was also consolation in the sighting of *Tortula freibergii* on rocks by the river. This moss has one of its British strongholds in North-east Yorkshire and is found along the River Esk from Egton Bridge downriver to Sleights. *Homalia trichomanoides* was seen in the same place.

The group drove to Glaisdale to spend the remainder of the day in East Arncliffe Woods. The river again thwarted our attempt to refind *Discelium nudum* which had been recorded on the clay banks of the river in 1967 during a visit to the woods by the British Bryological Society. However, *Pohlia lutescens* was found on the shale by the river, a new record for the woods.

There is a long list of bryophytes recorded from East Arncliffe Woods since the middle of the nineteenth century. Many of these have been refound since the early 1990s and each visit reveals new treasures. Among them on this occasion was *Dicranodontium denudatum* on a sandstone boulder. This is only the second record for VC 62, the other site being at Hawnby in 1896. *Dicranum fuscescens* was found close by. Several *Scapania* species were seen on the sandstone boulders. *Scapania umbrosa* grows in substantial patches, whilst *S. nemorea* was seen occasionally, with its brown gemmae clusters. *S. gracilis* was a new record for the woods.

Tetraphis pellucida is a common moss on the shaded rocks, and was found with capsules. On the ground and on boulders several patches of the beautiful *Rhytidiadelphus loreus* were seen, and *Hookeria lucens* was also present. *Marsupella emarginata* var. *emarginata* was frequent by the main track, and *Cephalozia lunulifolia* was also present on moist sandstone. *Herzogiella seligeri* was found, with abundant capsules, growing on an old branch lying on the ground. This is only its third known site in the vice county. This moss has a disjunct distribution in England, with its stronghold in the south east of the country.

Arguably the find of the day was the liverwort *Harpanthus scutatus*, scattered over all the steep bouldery slope. This plant was discovered here in 1847 and refound in 1967 and it was most satisfying to reconfirm its presence. It is extremely rare in eastern England. A *Metzgeria* species was seen on the same slopes, growing in loose wefts on a rock. It was hoped that this would be *Metzgeria conjugata*, for which there is an old record here from 1847 but, on microscopic examination, the specimens were ambiguous and not satisfactorily identifiable.

East Arncliffe Woods is the richest woodland in North-east Yorkshire and never fails to reveal new records. We recorded 66 taxa on the day, before rain curtailed activities. Over 130 species have been recorded in the woods since 1992.

Austerfield (VC 63), 7 May 2005 (TLB)

Austerfield, close to the boundary with Nottinghamshire at Bawtry, lies in a part of Yorkshire little visited in the past by YNU bryologists. However the old sand quarry on the western side of the village, now managed in the care of the Mosaic Trust, was thought to be a potentially interesting site which would repay close scrutiny. 42 species were recorded there, and in the adjacent King's Wood, by Colin Wall during survey work in 1993/94. Our visit on this occasion was assisted by Peter Rose of the Mosaic Trust, who welcomed us to the site and showed us around.

Acid sand is not usually a very rich habitat for bryophytes. As expected the first areas of open sand that we examined supported *Ceratodon purpureus*, *Polytrichum juniperinum* and plentiful *Brachythecium albicans*. *Polytrichum piliferum* was added to the list a little later. *Campylopus introflexus* formed extensive sheets in places. Rather more surprising in this habitat were the dense patches of *Barbula convoluta* and *Didymodon insulanus*, species not indicative of very acid ground. The most notable moss on the drier areas of sand was *Bryum algovicum*, with abundant capsules just beginning to mature. Older parts of the site are being colonised by birch, and there are a number of damp hollows and pools. *Drepanocladus aduncus* occurred in several of these, including ones with no standing

water at the time of our visit. *Calliergonella cuspidata* was also in some of the moister spots, and *Calliergon cordifolium* by one pool. The most significant record of the day was the discovery of plentiful scattered plants of the small liverwort *Fossombronia incurva* on moist, bare sand. This species has been recorded only once previously in Yorkshire, near Pilmoor (VC 62) in 1967. Other colonists of the damp sand included *Aneura pinguis*, *Riccardia chamedryfolia* and *Pohlia annotina*.

Several other interesting finds were made in the young birch woodland. There were several patches of *Lophocolea semiteres*, a species which has almost certainly been introduced to Britain from the Southern Hemisphere. It is a rare but increasing species in Britain and was found for the first time in Yorkshire in 2004 by Colin Wall at Hatfield. Another leafy liverwort on sandy ground was *Lophozia excisa*. This is the first confirmed record for this species for many years in VC 63. The moss *Aloina aloides* was found on a mound of sandy earth.

The pond at Willow Holt provided additional diversity. Epiphytes were better developed here than elsewhere on the site, especially on elder and sallow. They included *Ulota phyllantha* and *U. crispa* s. lat. (a sterile tuft), as well as *Orthotrichum affine* and *O. diaphanum*. The concrete wall of a drain-crossing a little further south had numerous tufts of *Zygodon viridissimus* var. *viridissimus*.

We also made a brief visit to the adjacent King's Wood, which was found to have a rather limited bryophyte flora. However we added several species to the day's list, including *Plagiothecium undulatum*.

The number of significant records made in the sand quarry fully justified our visit and confirmed that this is a very important conservation site for bryophytes in the Doncaster region. We recorded 52 species in the sand quarry, and a further 6 in King's Wood.

Foxup Gill (VC 64), 15 October 2005 (TLB)

Foxup Beck lies near the hamlet of Halton Gill below the northern slopes of Pen-y-ghent Hill. The underlying rock is Carboniferous Limestone, and the gill begins at 300m. The flora has an upland character, with yellow mountain saxifrage *Saxifraga aizoides* occurring in flushed stony ground.

Eight members joined the excursion, an unusually high number for our bryological section meetings. Initially, we spent a lot of time examining the walls and waysides at the bottom of the Gill, where many common calcicoles were present in good condition and in good quantity. There were very fine patches of *Ditrichum gracile*, especially near the bases of walls, *Scapania aspera* was plentiful, and *Porella cordaeana* was also seen. A tuft of *Ulota phyllantha* was noted on an ash tree. We examined the gill proper as far as the large crag near Foxup Beck Cave, at 360m. The handsome *Breutelia chrysocoma* was frequent on rock ledges and in damp grassland and flushed areas. On rock outcrops and crags we were able to see many of the distinctive mosses which have their centre of distribution on these upland limestones. They included *Mnium thomsonii*, *Plagiopus oederianus*, *Seligeria trifaria* s. lat. and the liverwort *Pedinophyllum interruptum*. The *Seligeria* was persistently sterile, and it was not possible to confirm whether or it belonged to *S. trifaria* s. str. or to *S. patula*, a species which has only recently been recognised in Britain.

The large thallose liverwort *Conocephalum* was present in many of the recesses on the crags, all of it referable to the recently recognised segregate species *C. salebrosum*. The ecology of this species and the well-known *C. conicum* is still being investigated in Britain, but *C. salebrosum* is thought to have a wider ecological tolerance. *C. conicum* appears to be restricted to wetter sites and may prove to have a more lowland distribution.

Among other less common species seen on the limestone crags were *Blepharostoma trichophyllum* (creeping sparsely among other bryophytes), *Apometzgeria pubescens*, *Leiocolea alpestris*, *Tritomaria quinquedentata*, *Cololejeunea calcarea*, *Preissia quadrata*, *Distichium capillaceum*, *Didymodon spadiceus*, *Bryum elegans* and *Orthothecium intricatum*. *Plagiochila britannica* was also found, in the form with distinctive jagged leaves. There were a number of small flushes and runnels, but these were not especially

rich. *Jungermannia exsertifolia* and *Philonotis calcarea* were among the species seen. Boulders in the streambed were very mossy, with *Cinclidotus fontinaloides*, *Didymodon luridus*, *Schistidium platyphyllum* and *Hygrohypnum luridum*, among others.

109 species were recorded in total.

Grimwith Reservoir (VC 64) 13 May 2006 (JMB)

The main purpose of the meeting was to explore the ground at the north-west end of Grimwith Reservoir. The walls and rocks around the car park were examined and produced a good mix of mosses, including *Grimmia pulvinata*, *G. trichophylla*, *Orthotrichum anomalum*, *O. cupulatum*, *Pseudocrossidium revolutum*, *Racomitrium lanuginosum*, *Schistidium crassipilum* and *Syntrichia ruralis*. The grassy areas had much *Calliergonella cuspidata* and *Rhytidiadelphus squarrosus*. Working our way round the western side of the reservoir, *Climacium dendroides* and *Thuidium tamariscinum* were plentiful by the track and *Pohlia annotina* was also seen here, whilst rocks produced *Dichodontium pellucidum* and several fine patches of the attractive liverwort *Tritomaria exsectiformis*.

At the far end of the reservoir epiphytes were sparse, with only *Orthotrichum affine* and *O. diaphanum* seen. Rocks in the streams running into the reservoir had *Fontinalis antipyretica*, *Hygrohypnum ochraceum*, *Racomitrium aciculare* and *Jungermannia sphaerocarpa*. The grassland produced five common *Sphagnum* species, *Aulacomnium palustre*, *Calliergon stramineum*, some good-sized patches of *Polytrichum strictum* and *Odontoschisma sphagni*.

Up the track beyond the reservoir old lead-mine workings were examined. *Brachythecium albicans* was present and *Encalypta streptocarpa*, *Hylocomium splendens*, *Racomitrium ericoides*, *R. fasciculare*, *Ptilidium ciliare* and *Scapania aspera*. *Barbilophozia atlantica* and *Gymnocolea inflata* were found growing on block scree on Long Hill escarpment. The acidic rocks on the crags were disappointing. Returning to the reservoir, a base-rich flush had *Bryum pseudotriquetrum*, *Campylium stellatum*, *Cratoneuron filicinum*, *Palustriella commutata* and *Scorpidium cossonii*.

On a cold day when, fortunately, the rain held off for most of the time, a total of 84 species was recorded.

Colsterdale Head (VC 65), 14 October 2006 (TLB)

This area was chosen as a venue because it is in a poorly recorded part of the vice-county. The underlying rock is gritstone and shale, but the exposures are generally unstable and there are no massive crags. We recorded in the area of Beldin Gill and its junction with Steel House Gill. In the former *Pogonatum urnigerum* was plentiful on bare mineral soil, and *Seligeria recurvata* in pure patches on limited exposures of grit rock. *Ptilidium ciliare* was also present. Although the rock was clearly unremittingly acidic it was odd to find a patch of *Encalypta streptocarpa* on one shaly ledge. A wet landslip area with bare clay had *Dicranella rufescens* and *Pohlia annotina*. The top of an old derelict wall produced, unexpectedly, patches of *Lophozia bicrenata* on thin peaty soil. Towards the head of the small Gill there is a waterfall with some wet rocks nearby. *Nardia compressa*, *Jungermannia sphaerocarpa* and *J. pumila* occurred here, and also *Pellia endiviifolia*, revealing by its characteristic autumnal furcate branching that it is not only a plant of base-rich habitats. One vertical rock face had tufts of both *Andreaea rothii* and *A. rupestris*.

In Steel House Gill by the junction with Beldin Gill there is a stretch of steep bouldery bank with trees. The boulders here produced *Dicranum fuscescens*, *Barbilophozia attenuata* and *Scapania umbrosa*. Patches of *Sphagnum girgensohnii* were rather plentiful, and *S. russowii* and *S. subnitens* also occurred. *Marsupella emarginata* was by the stream. A single flush showed slight base enrichment, with *Palustriella commutata* and *Climacium dendroides*. Elsewhere in more characteristically acid ground we found *Calliergon stramineum*.

Although no exceptional habitats were found, we recorded a total of 78 species in 1km square 44/(SE)0979.

Records

We are particularly grateful for all records received during the past three years. Harry Lake, Joan Egan and Colin Wall have recorded extensively in South Yorkshire, and Colin Wall has also visited under-worked areas in the East Riding. The list below includes new vice-county records and other records of note. An asterisk indicates a new or updated vice-county record. Recorders' initials: JMB = J.M. Blackburn; TLB = T.L. Blockeel; RWMC = R.W.M. Corner; JE = J. Egan; JK = J. Knight; HL = H. Lake; CW = C. Wall.

Aloina ambigua: (63) 44/51 Skelbrooke Churchyard, CW, 10 Aug. 2005; 44/60 Moor Dike Track, Hatfield Moor, CW, 27 Sept. 2005.

Bryum radiculosum: (62) 45/52 On wall, South Gare, Teesmouth, JMB, 17 Sept. 2002.

Campyliadelphus chrysophyllus: (61) 44/87 Rowgate Quarry, CW, 11 Sep 2006; (63) 44/50 Levitt Hagg, Sprotbrough, CW, 27 June 2004.

Campylium stellatum var. ***protensum***: (63) 44/50 Levitt Hagg, Sprotbrough, CW, 3 May 2006; 44/40 Stables Wood, Barnburgh, CW, 7 Aug. 2004.

Campylium stellatum var. ***stellatum***: (61) 44/87 Rowgate Quarry, CW, 11 Sept. 2006; 44/86 Fairy Dale, CW, 11 Sept. 2006; 44/93 Disused railway cutting, NE of South Cave, CW, 15 Aug. 2006; (63) 44/50 Levitt Hagg, Sprotbrough, CW, 27 June 2004.

Campylopus fragilis: (65) 34/69 Ledge on Silurian rocks, Black Force and Great Ulgill, TLB, JMB and RWMC, 5 June 2004.

***Cephalozia connivens*:** (63) 44/60 Hatfield Moor, CW, 11 June 2004.

Climacium dendroides: (61) 44/87 Rowgate Quarry, CW, 11 Sept. 2006.

Cryphaea heteromalla: (61*) 44/93 On *Sambucus*, The Warrens, NE of South Cave, CW, 15 Aug. 2006; (63) 43/49 Grange, HL, 4 Aug. 2004; (63) 44/40 Hooton Pagnell, TLB, 31 Oct. 2004; 43/48 Woodhall, HL, 12 Oct. 2004; 44/50 On *Salix*, Sprotbrough Flash, CW, 18 Oct. 2005; 44/30 Hemingfield, HL, 7 Dec. 2006; 44/71 On *Salix*, Will Pits, Thorne Moors, CW, 1 Aug. 2004; 43/58 On Elder, Roche Abbey, Maltby, CW, 26 Apr. 2006; 44/61 On *Sambucus*, Thorne Ashfields, CW, 22 March 2006; 43/69 On *Quercus*, Bawtry Forest, CW, 21 Aug. 2004. *Cryphaea* has been one of a number of beneficiaries of recent reductions in SO_2 pollution. As the recent records show it has become widespread even in South Yorkshire.

Dichodontium flavescens: (62) 45/70 By the River Esk, East Arncliffe Woods, Glaisdale, JMB, 29 Apr. 2005.

Dicranum polysetum: (63*) 44/70 On peat, ride through *Betula* scrub, Hatfield Moor, CW, 20 March 2006. One of the most interesting records in recent years. *D. polysetum* is a boreal species, and rare throughout Britain. It has, however, long been known in VC 62.

***Didymodon tomaculosus*:** (63) 43/49 Clay soil at edge of fallow field, Lawn Plantation, Swinton, TLB, 31 Oct. 2004. A new 10km square for this rare but inconspicuous species.

Ephemerum serratum var. ***serratum:*** (62) 44/49 Cod Beck Reservoir, Osmotherley, JMB, 28 Oct. 2003.

Fissidens viridulus: (63*) 43/39 Bare soil in fallow field, by Abdy Lane, Swinton, TLB, 31 Oct. 2004.

Fossombronia incurva: (63*) 43/69 Moist sand by pool in old sand quarry, Austerfield, TLB, YNU Excursion, 7 May 2005.

Frullania fragilifolia: (65) 34/69 Silurian rock crag in gully, Black Force and Great Ulgill, TLB, JMB and RWMC, 5 June 2004.

Grimmia dissimulata: (64) 34/67 On limestone boulder in grassland, south side of Helks Wood, Ingleton, TLB, 25 March 2006. *G. dissimulata* is close to *G. trichophylla* and has only recently been segregated from it; unlike the latter, it is characteristic of calcareous rocks.

Grimmia donniana: (65) 34/69 Small stones in scree, Black Force and Great Ulgill, TLB, JMB and RWMC, 5 June 2004.

Hennediella stanfordensis: (63) 43/59 Maltby, HL, 15 Dec. 2004.

Homomallium incurvatum: (65*) 45/10 On stones in shade, and on slab on top of retaining wall, Whitcliffe Wood and Scar, Swaledale, TLB, 15 July 2006. The first record of *Homomallium* in VC 65 for nearly a century; full details are given in Blockeel (2007).

Hylocomium splendens: (61) 44/87 Rowgate Quarry, CW, 11 Sept. 2006; 44/85 Chalk pit, Worsen Dale, Bishop Wilton, CW, 13 June 2006; 44/93 Disused railway cutting, NE of South Cave, CW, 15 Aug. 2006; (63) 43/29 Townend Common, HL, 7 March 2005; 44/30 Pit spoil, Hemingfield, HL, 9 Dec. 2006. *H. splendens* is rare in South Yorkshire and the East Riding.

Hypnum lindbergii: (65) 44/17 On exposed margin of reservoir, Leighton Reservoir, TLB, 14 Oct. 2006.

Isopterygiopsis pulchella: (65) 34/69 Rock ledge on Silurian rocks, Black Force and Great Ulgill, TLB, JMB and RWMC, 5 June 2004.

Isothecium myosuroides var. ***myosuroides:*** (61) 54/26 Danes Dyke, Bridlington, CW, 7 Aug. 2006; (63) 44/71 Pony Bridge Wood, Thorne Moors, CW, 24 July 2004.

Leptobarbula berica: (62) 44/77 North-facing limestone wall, Coneysthorpe, JMB, 12 Nov. 2005.

Leucodon sciuroides var. ***sciuroides:*** (63*) 43/48 Brick wall of culvert, Woodhall, HL, 12 Oct. 2004. A very unexpected and curious record. *Leucodon* occurs on both trees and rocks, but it disappeared from much of Yorkshire when air pollutants were high. Because it is usually sterile and lacks vegetative propagules, it is slow to recolonise. When it occurs on walls, the substrate is usually limestone. Its occurrence in the 'M1 corridor' of South Yorkshire is therefore surprising.

Lophocolea semiteres: (61*) 44/74 On peaty sand, Allerthorpe Common, CW, 5 Sept. 2006; (63*) 44/60 Hatfield Moor, CW, 8 Dec. 2004. *L. semiteres* is generally acknowledged to be an introduced species from the southern hemisphere.

Lophozia excisa: (63*) 43/69 Sandy ground among birches, sand quarry, Austerfield, CW, 7 May 2005.

Marsupella sprucei: (65) 34/69 On small stone in scree, Black Force and Great Ulgill TLB, JMB and RWMC, 5 June 2004.

Metzgeria fruticulosa: (61) 44/85 On *Salix*, Whitekeld Dale, Givendale, CW, 31 May 2006; 54/27 On Elder, Danes Dyke, Bridlington, CW, 30 Aug. 2006; 44/84 On *Fraxinus*, railway cutting, Market Weighton, CW, 11 July 2006; (63) 43/38 Sorby Plantation, JE and HL, 8 Apr. 2005; 44/50 On *Acer*, Scabba Wood, Sprotbrough, CW, 11 July 2004; 44/71 On *Salix*, Rawcliffe Moor, Thorne Moors, CW, 12 Apr. 2006; 44/71 On *Salix*, Pony Bridge Wood, Thorne Moors, CW, 24 July 2004; 44/71 On *Salix*, Will Pits, Thorne Moors, CW, 5 Feb. 2006; 44/50 On *Salix*, Sprotbrough Flash, CW, 18 Oct. 2005; 43/59 On *Sambucus*, Roche Abbey Valley, Maltby, CW, 26 Apr. 2006; 43/58 On *Sambucus*, Roche Abbey, Maltby, CW, 26 Apr. 2006. *M. fruticulosa* is another beneficiary of recent reductions in SO_2 pollution.

Microbryum davallianum: (61) 44/87 Rowgate Quarry, CW, 11 Sept. 2006.

Microbryum floerkeanum: (63) 44/40 Maize field on clay, Hooton Pagnell, TLB, 31 Oct. 2004. Second recent record for VC 63.

Microbryum rectum: (63) 43/59 Maltby, HL, 15 Dec. 2004.

Mylia anomala: (61*) 44/63 Wet peaty ditch bank, Skipwith Common, CW, 6 Nov. 2006; (63) 44/60 Wet peat, birch woodland, Hatfield Moor, CW, 18 Oct. 2004.

Orthothecium intricatum: (62) 44/89 Hudson's Cross, Levisham Moor, JMB, 20 July 2004.

Orthotrichum lyellii: (63) 43/48 Woodhall, HL, 12 Oct. 2004; 43/29 Deepcar, HL, 13 Apr. 2005; 43/48 Whiston Meadows, HL, 11 Feb. 2004; 44/30 On *Salix fragilis*, Honeywell, HL, 6 Nov 2006.

Orthotrichum pulchellum: (61) 44/84 On *Fraxinus*, disused railway cutting, Market Weighton, CW, 11 July 2006; 44/85 On *Sambucus*, Deepdale, Bishop Wilton Wold, CW, 8 June 2006.

Orthotrichum stramineum: (63) 43/38 Deciduous woodland, Ecclesall Wood, Sheffield, JE, 4 March 2005; 43/38 Limb Valley, JE and HL, 4 March 2005; 44/71 On *Salix*, Will Pits, Thorne Moors, CW, 24 Apr. 2006; (65) 45/01 On *Fraxinus*, wooded valley, Deepdale, Bowes, TLB, 29 Aug. 2005.

Orthotrichum striatum: (63*) 43/58 On ?*Fraxinus*, deciduous woodland, Firbeck, HL, 10 May 2005.

Plagiothecium curvifolium: (61) 44/74 Allerthorpe Common, CW, 5 Sept. 2006.

Plagiothecium latebricola: (62*) 44/67 Hollin Hill Bogs, Castle Howard Estate, JMB, 5 Nov. 2004.

Ptilidium pulcherrimum: (63) 44/71 Will Pits, Thorne Moors, CW, 1 Aug. 2004; 44/71 Pony Bridge Wood, Thorne Moors, CW, 24 July 2004.

Pylaisia polyantha: (65*) 45/10 Bole of *Acer*, wooded bank of R. Swale, West Wood, TLB, 16 July 2006.

Radula complanata: (63*) 44/61 Inkle Moor, Thorne Moors, CW, 1 July 2005; 44/71 On *Crataegus* and *Salix*, Will Pits, Thorne Moors, CW, 5 Feb. 2006; 44/51 On *Fraxinus*, Brockadale Nature Reserve, Wentbridge, CW, 10 May 2006; 44/50 Sprotbrough Flash, CW, 18 Oct. 2005. Another epiphyte that is beginning to recolonise South and East Yorkshire.

Rhizomnium pseudopunctatum: (62*) 44/89 Saltergate Gill, Newtondale, JMB, 28 July 2004.

Rhytidiadelphus loreus: (63) 44/60 Station Wood, Barnby Dun, CW, 6 March 2006.

Rhytidiadelphus triquetrus: (63*) 44/30 Woodland on pit spoil, Wombwell, HL, 2 Nov. 2005. A very surprising record: *R. triquetrus* is almost confined to limestone substrates in the South Yorkshire/Peak District regions, and it had not been recorded in VC 63 for more than a century.

Riccardia palmata: (63*) 34/93 Log on bank of side stream, deep wooded valley on Millstone Grit, Hardcastle Crags, TLB, YNU Excursion, 8 May 2004.

Riccia huebeneriana: (65*) 44/17 on exposed mud of reservoir, Leighton Reservoir, TLB, 14 Oct 2006. New to VC 65, but long known from Gouthwaite Reservoir not far away in VC 64.

Scapania irrigua: (61*) 44/74 Woodland ride, Allerthorpe Common, CW, 5 Sept. 2006; (63) 44/30 Woodland path, Wombwell Wood, HL, 18 Sept. 2006.

Schistidium elegantulum subsp. ***elegantulum:*** (65*) 45/10 Small stone under *Fraxinus* and *Crataegus*, Whitcliffe Scar, Swaledale, TLB, 15 July 2006. One of the segregates of the *S. apocarpum* complex.

Schistostega pennata: (62*) 45/60 Disused quarry south of Castleton, JK and JMB, 26 Apr. 2004.

Seligeria calcarea: (61) 44/93 Disused railway, N.E. of South Cave, CW, 15 Aug. 2006; 44/85 Exposed chalk, Worsen Dale, Bishop Wilton, CW, 13 June 2006.

Sphagnum capillifolium subsp. ***capillifolium:*** (63*) 44/60 Wet peat, birch woodland, Hatfield Moor, CW, 19 Jan. 2006.

Sphagnum inundatum: (61) 44/74 Allerthorpe Common, CW, 5 Sept. 2006.

Sphagnum papillosum: (61) 44/63 Skipwith Common, CW, 6 Nov. 2006.

Syntrichia laevipila var. ***laevipila:*** (63) 44/52 Epiphyte on *Salix*, Sprotbrough Flash, CW, 27 June 2004; 43/59 Epiphyte, Nearcliff Wood, Conisbrough, CW, 4 Oct. 2006; (65) 34/99 base of *Fagus*, wooded gill, Mill Gill, TLB, 17 July 2005.

Syntrichia virescens: (63) 43/49 Tree between canal and river, R. Don, Mexbrough, HL, 16 Apr. 2004; 44/50 Base of mature *Fraxinus*, Adwick-le-Street Churchyard, CW, 14 Nov. 2005; (63) 43/59 Base of mature *Fraxinus*, Conisbrough Churchyard, CW, 30 Sept. 2005.

Tortella bambergeri: (65*) 44/18 Exposed siliceous rock, rough grassland, Ever Bank, Middleham Low Moor, TLB, 16 July 2005. This species has only recently been clearly distinguished from the much commoner *T. tortuosa* (Bosanquet, 2006).

Tortula lanceola: (63) 43/48 Ulley, HL, 17 Nov. 2004.

Tortula marginata: (61) 44/95 Church wall, Wetwang, CW, 28 June 2006.

Tortula modica: (63) 44/40 Broomhill, HL, 10 Dec 2005; 43/49 Rawmarsh, HL, 21 June 2004; 44/70 Arable warpland, Hatfield Moor, CW, 1 Nov. 2005; 44/50 Adwick-le-Street Churchyard, CW, 14 Nov. 2005; 44/60 Kirk Sandall Churchyard, CW, 6 March 2005.

Trichostomum crispulum: (61) 44/93 Disused railway cutting, N.E. of South Cave, CW, 15 Aug. 2006.

Ulota bruchii: (61) 44/93 On *Fraxinus*, disused railway cutting, N.E. of South Cave, CW, 15 Aug. 2006; 44/87 On *Acer*, Woodland, Settrington Beacon, CW, 11 Sept. 2006; 44/84 On *Fraxinus*, disused railway cutting, Market Weighton, CW, 11 July 2006; 44/73 Epiphyte, by River Derwent, Bubwith, CW, 30 Nov. 2006.

Ulota crispa: (61*) 54/27 Epiphyte, Danes Dyke, Bridlington, CW, 30 Aug. 2006; (63) 44/50 Woodland, Melton Wood, HL, 5 Nov. 2005; 44/71 On *Salix*, Will Pits, Thorne Moors, CW, 1 Aug. 2004.

Ulota phyllantha: (61) 44/84 On Ash, disused railway cutting, Market Weighton, CW, 11 July 2006.

Weissia brachycarpa var. ***brachycarpa:*** (63) 43/49 Field, wet clay, Wath-on-Dearne, HL, 29 Apr. 2004.

Weissia brachycarpa var. ***obliqua:*** (61) 44/85 Worsen Dale, Bishop Wilton, CW, 13 June 2006.

Zygodon conoideus: (63) 44/50 Potteric Carr, HL, 9 March 2004.

Zygodon viridissimus var. ***viridissimus:*** (61) 44/85 On *Acer*, Deepdale, Bishop Wilton Wold, CW, 31 May 2006.

Reference

Blockeel, T.L. (2007) The status and habitat of *Homomallium incurvatum* in the north of England. *Field Bryology* **91:** 2-7.

Bosanquet, S.D.S. (2006) *Tortella bambergeri* (Schimp.) Broth. in the British Isles. *Journal of Bryology* **28:** 5-10.

BOOK REVIEW

Trees. A Field Guide to the Trees of Britain and Northern Europe by **John White, Jill White** and **S. Max Walters.** Pp. xvi + 431 with numerous colour plates. Oxford University Press. 2005. £25 hardback.

It is claimed in the introduction that the sole objective of this book is identification. The book is divided into 17 chapters, each dealing with a group of trees whose leaves have similar characters and a similar arrangement on the twig. At the beginning of the book a leaf icon is shown with a brief description of the leaf characters, e.g. "lobed leaves, clearly toothed: alternate" and one is referred to the relevant chapter; but the clues stop there. One must then look at the photographs of which there are several for each species and read through the descriptions. This can be time consuming, especially with the longer chapters, and the book might be better used in conjunction with the dichotomous key in a standard flora when the descriptions and photographs might help to confirm the identification. Over 400 species, subspecies and varieties of trees are dealt with. These may be found in the wild or in parks, arboreta or gardens in Britain. Trees of the same family may appear in different chapters depending on the leaf characters. The descriptions are helpful and most, but not all, of the photographs are clear and useful.

PPA

ENTOMOLOGICAL REPORT: DIPTERA (TIPULOIDEA AND EMPIDOIDEA)

ROY CROSSLEY

The last report covering these two Superfamilies was published in 2004 (*Naturalist* **129**: 153-156). Since then much recording has continued across the county and a selection of the more significant discoveries is noted below.

An important event in 2006 was the publication by the Thorne and Hatfield Moors Conservation Forum of 'An Inventory of the Invertebrates of Thorne and Hatfield Moors' (Thorne & Hatfield Moors Monograph No.2) by Dr Peter Skidmore, edited by Professor P.Buckland. This masterly work is now the definitive source of information for these important sites and some of the Diptera records are reproduced herein (as 'per P.S.').

It is always a pleasure to acknowledge the support of colleagues who submit records – P.J.Chandler, J.H.Cole, W.R.Dolling, W.A.Ely, A.Godfrey. I am also obliged to Andrew Grayson for drawing to my attention additional records from various sources. Unattributed records are those of the author.

The systematic order of the following list and nomenclature follow Chandler (1998). Where appropriate, the national rarity classifications which follow the species names [in squared brackets] are those provisionally recommended by Falk (1991) for Tipuloidea and by Falk and Crossley (2005) for Empidoidea.

TIPULIDAE

Tipula (s.g. *Lunatipula*) *peliostigma* Schumm. [Nb]

A single male was swept, 30/6/2005, near an ancient hedgerow in a traditional winter-flooded hay meadow at Breighton Meadows (VC 61) which forms the southern limit of the Lower Derwent Valley National Nature Reserve. Adults of this species have been reared from bird nests, including Robin and Blackbird, but it is unclear whether this is a major or subsidiary larval habitat as there are other records referring to their occurrence in damp woodland soil (Falk, 1991). There is one previous Yorkshire record: Kelfield (VC 61), 12/7/1941, and a possible one from Hornsea Mere (VC 61), 1979.

LIMONIIDAE

Hoplolabis (s.g. *Parilisia*) *areolata* (Siebke)

Although previously reported in all five vice-counties, this is a very scarce Yorkshire species, and half of the records refer to river banks. The most recent are from the banks of the River Derwent at Stamford Bridge, 14/6/2005, and the R.Ure at Beningborough, 8/7/2005.

H. (s.g. *P.*) *vicina* (Tonn. in Goet. & Tonn.)

Another very scarce species in Yorkshire, this is found on river banks and also in generalised wetland sites. Recent examples are from Hatfield Moor 2004 (the first record for VC 63) per P.S. and the bank of the R.Swale upstream from Richmond, 29/7/2005.

Molophilus (s.g. *Molophilus* s.s.) *pusillus* Edw.

Known from four localities in the north-west of the county, and single sites in VCs 62 and 63, the discovery of specimens by the banks of the infant Nidd at Lofthouse 26/7/2005 adds the species to VC 64. All Yorkshire records are post-1985, which may either reflect increased collector activity or that *M.pusillus* is spreading.

Dactylolabis (s.g. *Dactylolabis* s.s.) *transversa* (Mg.) [Nb]

A single male was found at a coastal soft-cliff seepage, Hayburn Wyke, 1/7/2006. This is the first record for the eastern half of Yorkshire, all previous localised reports being from Pennine areas, about half of which are attributable to the late Chris Cheetham prior to 1940.

Eloeophila verralli (Bergroth) [Nb]
Rother Bog (VC 63), 1981, leg. T.Bird, det. A.E.Stubbs (per D.Whiteley – 'Sorby' database). A very localised species in Yorkshire with only five known localities scattered across all vice-counties, except VC 61. All records, except for the Rother Bog reported here, are from stream-, or river-sides.

Limonia stigma (Mg.)
Although first reported in the county from Forge Valley Woods, NNR (VC 62) 16/7/1997 (*Naturalist* **123**: 120), earlier VC 63 records have been submitted: Went Valley/Brockadale 24/7/82; King's Wood, Roche Abbey, 1/8/82, all W.A.E.

HYBOTIDAE
Bicellaria nigrita Collin
Reported from Scaleber Force near Settle 12/6/1999, J.H.C. (per A.Grayson). This is only the second record for Yorkshire, the first being King's Wood near Maltby in the far south of the county, 22/6/1979, W.A.E.

Stilpon graminum (Fall.)
A male of this minute ground-dwelling fly found in litter at Askham Bog, 16/4/2005, leg. W.R.D., det. R.C., constitutes the first record for the county. A further specimen was found at Upper Dunsforth Carrs, 22/9/2005, A.Godfrey.

S. nubilus Collin
Several examples of this even smaller fly were found beneath mat-forming vegetation on cindery ground at the side of a track at Sunk Island (VC 61), 16/9/2004, leg. W.R.D., det. R.C. This is the first recorded occurrence in Yorkshire for what is probably a much overlooked species.

Platypalpus stabilis (Collin)
Low Mill, Farndale, (VC 62), 27/7/2006; there are only two previously reported occurrences in Yorkshire: river-bank shingle, East Keswick Fitts (VC 64), 1985, and Hornsea Mere (VC 61), 1996.

Tachydromia costalis (von Roser)
Two males and a single female swept from tree foliage in the vicinity of Gunnerside (VC 65), 27/6/1981, P.J.C., have only recently come to notice and constitute the earliest known Yorkshire record for this species. Subsequently it has been recorded from Castle Hill Wood, Helmsley (VC 62), 1/7/1994 and near Hudswell Wood, upstream from Richmond (VC 62), 8/6/2004.

EMPIDIDAE
Empis (s.g. *Lissempis*) *nigritarsis* (Mg.)
A single male at Oak Hill, near Goole (VC 63), 14/6/2006, is only the second record for the county, the first being a male at Skipwith Common 22/5/1998. Widespread in woodlands of southern Britain, the recent Yorkshire examples may be the harbingers of a northward range extension.

Hilara gallica (Mg.) [RDB2]
Several examples of both sexes were swept from tree foliage on the margins of North Cliffe Wood (VC 61) during June 2006. For an account of this species in Britain see *Naturalist* **124**: 86. The North Cliffe site is an extension to the known range of this rare species of lowland sandy heath in Yorkshire, the other site being Cali Heath near Barmby Moor.

Rhamphomyia (s.g. *Amydroneura*) *gibba* (Fall.)
A single female at North Cliffe Wood, 22/7/2006, is the first record for VC 61. Elsewhere in Yorkshire it is widely, but locally, distributed, with a concentration of localities in the far south of VC 63.

DOLICHOPODIDAE

Chrysotus laesus (Wied.)
Hatfield Moor (VC 63), 2005, per P.S. Only known elsewhere in Yorkshire from Haugh Rigg, 1996 (*Naturalist* **124**: 86).

C. melampodius Lw. [Nb]
Hatfield Moor (VC 63), 2005, per P.S., the first record for the county.

C. suavis Lw.
Thorne Moors (VC 63), 2000, per P.S., is only the second Yorkshire record, the first being Nosterfield Gravel Pits (VC 65), 10/8/1998.

Diaphorus oculatus (Fall.)
Upper Dunsforth (VC 64), 8/8/2005. This is a very localised fly in Yorkshire, known elsewhere in the county from Askham Bog, and Ashberry and Sand Dale in the North York Moors National Park. There are old Chris Cheetham records from Austwick and Lawkland Mosses.

Melanostolus melancholicus (Lw.) [Nb]
Hatfield Moor, 2005, per P.S., is the first record for VC 63, the others from Yorkshire being Sewerby Cliffs (VC 61), 1997 and Sand Dale (VC 62), 2006.

Dolichopus phaeopus Hal. in Walker.
Frequent at Tranmire Bog and nearby peat-bogs on Wheeldale Moor (VC 62), 2005/2006. Otherwise only known with certainty at lowland peat sites near Thornton (Lower Derwent Valley National Nature Reserve, VC 61). It is possible that this species could be confused, especially in the females, with dark-legged forms of *D. vitripennis* Mg., which is often an abundant fly of wet peat habitats.

Tachytrechus consobrinus (Hal. in Walker) [Nb]
Hatfield Moor (VC 63), from the shore of a sandy lagoon, 2004 (Skidmore & Ackland, 2006). Known elsewhere in the county from two peat-bog sites on the North York Moors: Fen Bog, 2002 and Bonfield Gill, 2003.

T. insignis (Stann.)
Hatfield Moor (VC 63), 2005, per P.S. The only other Yorkshire record is from Kilnsea, (VC 61), where specimens were found in 2001 on bare, wet sand by a drain near Beacon Ponds.

Chrysotimus molliculus (Fall.)
Hatfield Moor (VC 63), per P.S. There is a record for this tiny fly from Millington, (VC 61) in 1936 by H.C.Audcent of Bristol, who was visiting his friend Dr W.J.Fordham at Barmby Moor, after which there were no further county records until 1996 when specimens were found at Wheldrake Woods; subsequently it has been recorded from a further five lowland sites, mostly sandy heathland, and always swept from tree foliage. The Hatfield record is the first for VC 63.

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BOOK REVIEW

An Inventory of the Invertebrates of Thorne and Hatfield Moors by **P. Skidmore.** Pp.162, with 19 colour plates and 3 site maps; paperback. Thorne & Hatfield Moors Conservation Forum. £15 + £3.50 p & p from the Hon. Publications Officer, Chris Bowes, 19 Cotswold Road. Thorne, Doncaster DN8 5RW.

Thorne and Hatfield Moors remain the largest areas of lowland raised mire in England, despite centuries of peat extraction and severe habitat degradation in recent decades; they still support an extensive and impressive invertebrate fauna. This volume is the result of many years of recording by locally-based naturalists and visitors to these unique environments which are now, thankfully, Natura 2000 sites mainly under European protection, and undergoing restoration management by Natural England.

The lengthy introductory narratives deal, *inter alia*, with important paleo-entomological researches from which it has been established that the scarce peatland beetles have been present throughout the stratigraphical sequences. The history of biological recording on the Moors and past conservation conflicts are included, and there are useful accounts of the range of habitats to be found today and their associated invertebrate faunas. The extensive literature references to both published and unpublished material bear witness to the huge amount of past research which has been undertaken.

More than half the book is taken up with lists of all invertebrate taxa recorded to date, and columns show, by a clear coding system, the distribution of each species by habitat category, their regional and national status, the most recent year of recording, and analysis of pre-and post-1990 records; 4790 taxa are listed, of which 3487 are from Thorne and 3107 from Hatfield. The latter is quite remarkable because, due to access difficulties, Hatfield has been much less visited in the past than Thorne. To give an idea of the range of recording, the lists include 1383 Diptera, 1371 Coleoptera, 576 Lepidoptera, 21 Odonata, 57 molluscs, 250 spiders – one could go on; the sites must surely rank amongst the most comprehensively recorded in the country!

This is a thoroughly researched book, well produced on good quality paper, and a major work whose interest and usefulness extends well beyond South Yorkshire. With a stunning painting of the ground-beetle *Carabus nitens* set against the white outer cover, this publication shouts 'quality' as soon as you see it. Inside there are 19 coloured plates by the author, most of which are published here for the first time. In addition to being a distinguished entomologist, Peter Skidmore is an accomplished artist and one of the finest entomological illustrators in Britain today, and even if you are not an invertebrate worker the book is worth buying for the illustrations alone!

The Thorne and Hatfield Moors Conservation Forum is to be congratulated on publishing this important work which marks the culmination of years of research in a much loved and treasured landscape.

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Printed in Great Britain by Titus Wilson & Son, Kendal ISSN 0028-0771

July-September 2007

Number 1062
Volume 132

The Naturalist

A QUARTERLY JOURNAL OF NATURAL HISTORY FOR THE NORTH OF ENGLAND

Preliminary mapping of terrestrial mammal distributions in North Yorkshire 1996-2006 – *Geoff Oxford, James Mortimer, Ann Hanson, Simon Pickles and Michael Thompson*

Taxidermists from the Epworth district of North Lincolnshire – *Martin Limbert*

Recorder's ninth report of the Aculeate Hymenoptera in Watsonian Yorkshire – *Michael E. Archer*

Notes on some Diptera of a North Lincolnshire salt-marsh – *Roy Crossley*

Published by the Yorkshire Naturalists' Union

Editor **M. R. D. Seaward** MSc, PhD, DSc, FLS, The University, Bradford BD7 1DP

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PRELIMINARY MAPPING OF TERRESTRIAL MAMMAL DISTRIBUTIONS IN NORTH YORKSHIRE 1996-2006

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Background

The first comprehensive distribution maps of mammals in the historical county of Yorkshire, based on records gathered between 1971 and 1981, were published by Howes (1983) together with a brief review of previous mammal recording in the region. Updated versions of the maps were subsequently used as a key element in *Yorkshire Mammals* (Delany, 1985), since when there has been no concerted attempt to re-map the mammalian fauna of Yorkshire, although significant changes in the national distributions of some species are know to have occurred, for example, water voles (Strachan *et al.*, 2000), otters (Strachan & Jefferies, 1996; Crawford, 2003) and a number of deer (Ward, 2005).

In 1996, the Yorkshire Mammal Group (YMG) decided to collect records more systematically and appointed a Mammal Recorder, a position held for many years by Michael Thompson and more recently by James Mortimer. The aim was to publish a revised atlas of Yorkshire mammals in 2006, after a decade of recording and approximately 20 years on from Delany (1985). As the end of the designated period approached it became clear that we had relatively few records from areas other than North Yorkshire and that even here they were, on the whole, more a function of the distribution of recorders rather than of mammal species. It was therefore decided to (a) concentrate the mapping effort on North Yorkshire, (b) make a concerted effort to recruit more mammal recorders, especially in woefully under-recorded parts of the county, and (c) extend the recording period so that the final species distribution maps were robust and their interpretations meaningful. The aim of this paper is to draw attention to the areas of North Yorkshire that require enhanced survey effort and to encourage naturalists in those regions to make, and submit, their records (details below).

Survey area and scale of recording

Previous atlases of Yorkshire mammals (Howes, 1983; Delany, 1985) were based on the pre-1974 county boundary, enclosing five Watsonian vice-counties (VC 61-65). The current maps use the boundary of post-1974 North Yorkshire, comprising seven local government districts (Craven, Hambleton, Harrogate, Richmondshire, Ryedale, Scarborough and Selby) and York, a unitary authority (Fig. 1). The three unitary authorities of Redcar and Cleveland, Middlesbrough and the area of Stockton-on-Tees south of the Tees, which are also formerly part of the county of North Yorkshire created in the Local Government Act 1972, are not included. In terms of Watsonian vice-counties, the mapped area includes the vast majority of VCs 62, 64 and 65. The total area of the county of North Yorkshire is 8654 km^2, and that of the area mapped 8312 km^2. This is by far the largest modern English county, with the area used for mapping still over 1500 km^2 greater than that of the next largest county (Cumbria, 6768 km^2). To produce high density recording of the mammals in such a large area is a major challenge. As the boundary of North Yorkshire includes only a short stretch of coastline, we have restricted our mapping to terrestrial mammals.

Unlike national mapping schemes based on the 10 km squares of the Ordnance Survey National Grid (e.g. Ward, 2005), county atlases often record to the nearest tetrad i.e. 2 km x 2 km square (e.g. Yorkshire – Delany, 1985; Essex – Dobson, 1999; Hertfordshire – Clarke, 2001). If recording intensity is sufficient, they can be used to reveal local factors affecting mammal distributions. The majority of the records gathered by the YMG are associated with at least a four-figure map reference (i.e. located to within a 1 km grid square) and there seemed no good reason not to utilize the full degree of resolution possible in our plots. The locations of the two dormouse reintroductions, however, are deliberately left vague (10 km squares) because they occurred on privately owned land. For the deer species, we have mapped our own records in the usual way, but also include those from the British Deer Society recorded on a 10 km grid-square basis (see Ward, 2005); the latter were collected between 1972 and 2002, but as there were few losses from 10 km squares over this period, the combined data probably reflect current distributions (Alastair Ward, *pers. comm.*). The distribution of current recording effort is shown in Figure 2, and maps of all North Yorkshire's terrestrial mammals comprise Figures 3 to 43.

Terrestrial mammal checklist

Howes (1983) provided a full checklist of mammalian species found in Yorkshire, including those that became extinct in historical times and those present post-1800 but which had not been recorded since 1970. He also listed the marine mammals of the Yorkshire coast. The terrestrial mammal species currently known to be present in North Yorkshire are given below.

Order Insectivora
Hedgehog *Erinaceus europaeus* L.
Mole *Talpa europaea* L.
Common Shrew *Sorex araneus* L.
Pygmy Shrew *Sorex minutus* L.
Water Shrew *Neomys fodiens* (Pennant)

Order Chiroptera
Whiskered Bat *Myotis mystacinus* (Kuhl)
Brandt's Bat *Myotis brandti* (Eversmann)
Natterer's Bat *Myotis nattereri* (Kuhl)
Daubenton's Bat *Myotis daubentoni* (Kuhl)
Leisler's Bat *Nyctalus leisleri* (Kuhl)
Noctule *Nyctalus noctula* (Schr.)
Common Pipistrelle *Pipistrellus pipistrellus* (Schr.)[1]
Soprano Pipistrelle *Pipistrellus pygmaeus* (Leach)[1]
Brown Long-eared Bat *Plecotus auritus* (L.)

Order Lagomorpha
Rabbit *Oryctolagus cuniculus* (L.)
Brown Hare *Lepus europaeus* Pallas

Order Rodentia
Red Squirrel *Sciurus vulgaris* L.
Grey Squirrel *Sciurus carolinensis* Gmelin
Bank Vole *Clethrionomys glareolus* (Schr.)
Field Vole *Microtus agrestis* (L.)
Water Vole *Arvicola terrestris* (L.)
Wood Mouse *Apodemus sylvaticus* (L.)
Harvest Mouse *Micromys minutus* (Pallas)
House Mouse *Mus musculus* L.
Brown Rat *Rattus norvegicus* (Berkenhout)
Dormouse *Muscardinus avellanarius* (L.)[2]

Order Carnivora
Fox *Vulpes vulpes* L.
Pine Marten *Martes martes* (L.)[3]
Stoat *Mustela erminea* L.
Weasel *Mustela nivalis* L.
Polecat *Mustela putorius* L.[4]
American Mink *Mustela vison* Schr.
Badger *Meles meles* (L.)
Otter *Lutra lutra* (L.)

Order Artiodactyla
Red Deer *Cervus elaphus* L.
Sika Deer *Cervus nippon* Temminck
Fallow Deer *Dama dama* (L.)
Roe Deer *Capreolus capreolus* (L.)
Muntjac *Muntiacus reevesi* (Ogilby)

NOTES:
1 In the late 1990s the Pipistrelle bat was discovered to comprise two cryptic species, the Common Pipistrelle and the Soprano Pipistrelle (see Schofield (2002) for background and identification).
2 The Dormouse was thought be extinct in Yorkshire and the present two populations are the result of a national reintroduction programme (see Oxford, 2007).
3 Records of Pine Marten have been reported to the Vincent Wildlife Trust (VWT) and observers subjected to the standard set of interview questions designed to provide a measure of confidence. Those shown on the map have a confidence score of seven or above, where a 10 indicates the greatest confidence (Messenger & Birks, 2000).
4 The Polecat was, according to Howes (1983), present post-1800 but not recorded after 1970. The current record may be a result of a natural, recent eastwards expansion of range across England (see http://www.abdn.ac.uk/mammal/polecat_survey.shtml).

COMMENTARY ON PARTICULAR SPECIES

Although the primary purpose of this paper is to encourage more recording, there are some species whose distributions in North Yorkshire deserve specific comment.

Otter (*Lutra lutra*)

By the time *Yorkshire Mammals* was published (Delany, 1985), the otter in Yorkshire and elsewhere in lowland England had been in decline for a number of years (Strachan & Jefferies, 1996; Woodroffe, 1994). The relatively high density of otter records in the present survey, particularly in the North Yorkshire Moors and along rivers draining from them, largely reflect the success of reintroduction programmes that took place in the early 1990s (Woodroffe, 1994, 1997, 2006), and their subsequent monitoring. Records from the Yorkshire Dales might represent the expansion of remnant populations and/or migration from populations further west. It is also possible that some colonization may have occurred as a result of the reintroductions in the Derwent catchment. It should be noted that this species is likely to be under-recorded as a result of its nocturnal habits and its tendency to frequent remote habitats.

Water Vole (*Arvicola terrestris*)

Previous water vole records from North Yorkshire are patchy (Howes, 1983; Delany, 1985), probably reflecting more the activity of observers than the distribution of voles. Nonetheless, Howes (in Delany, 1985) reported that the species was in decline. Since then, the water vole has suffered a catastrophic country-wide reduction in distribution and numbers as a result of a combination of habitat degradation and fragmentation, and the spread of an introduced predator, the American mink *Mustela vison* (Woodroffe *et al.*,

1990; Lawton & Woodroffe, 1991; Strachan *et al*., 2000). In at least some areas the water vole may increasingly be confined to habitats that are not necessarily the most optimal, but are relatively mink-free (Barreto *et al*., 1998) or which may provide some protection from predation, e.g. reedbeds (Carter & Bright, 2003). Given this, the relatively large number of recent records probably reflects increased efforts to record the local distribution of this species (for example, the Yorkshire Wildlife Trust employs staff whose primary role is water vole conservation).

Muntjac Deer (*Muntiacus reevesi*)

This species has been introduced to various parts of the country (Chapman *et al*., 1994; Ward, 2005) and is considered a threat to some woodland plants such as bluebells (http://www.deer-uk.com/muntjac_deer.htm). Its small size means that it is less likely to be seen than other species of deer, or may be mistaken at a distance for a fox. Muntjac was classified as an escapee in Yorkshire by Howes (1983), but not mapped. Although there is only one YMG record (York) for this species, the British Deer Society survey shows that it is actually fairly widely distributed in North Yorkshire. Chapman *et al*. (1994) list three know escapes/releases in North Yorkshire: Studley Royal (SE2770, four animals, *c*. 1977), Scawton (SE5583, unknown number, 1991) and near Rievaulx (SE5785, one male, pre-1992), but others may have happened subsequently or gone unrecorded. Statistical modelling based on habitat preferences suggests that there is the potential for the species to become even more widespread in the county (Chapman *et al*., 1994)

Red Squirrel (*Sciurus vulgaris*)

The red squirrel in Britain has declined as the grey squirrel *S. carolinensis* has spread (e.g. Lloyd, 1983). Howes (in Delany, 1985) showed a small number of tetrad records for the red squirrel in North Yorkshire. Those in the North York Moors area may well have been misidentifications of rufous grey squirrels (Charles Critchley, *pers.comm.*) although one can never be sure that a residual population may not be hanging on. The current population of red squirrels in Widdale (southern cluster in Fig. 21) is confirmed, and appears to have colonized the area in the late 1990s from a remnant population in the Sedbergh (Cumbria) area (Court *et al*., 2007; Peter Lurz, *pers.comm.*). The Widdale, and Garsdale and Mallerstang, areas were designated in 2005 as two of a proposed 20 Red Squirrel Reserves, part of the North of England Red Squirrel Conservation Strategy (Court *et al*., 2007; http://www.redsquirrel.org.uk/FRIENDS/html/reserves_map.html). The status of the records further north in Wharfedale is less clear but might be part of the same expansion from Cumbria.

Further records

We urge readers to record the mammals in their areas, especially those parts of the county currently under-surveyed (Fig. 2). A Yorkshire Mammal Group recording form can be downloaded from its web-site (http://www.raysolve.co.uk/ymg/) or hard copies obtained from Geoff Oxford or Ann Hanson (contact details above). Notes on completing the form are available from the same sources.

Acknowledgements

Much of the data used here was contributed by members of the YMG, to whom we are extremely grateful. We thank the following for providing additional records and/or correspondence: John Altringham (University of Leeds); Nick Askew (University of York); Nevil Bowland (Wharfedale Naturalists); Derek Capes (YMG); Ian Court (Yorkshire Dales National Park); Charles Critchley (Forest Enterprise); John Drewett (North Yorkshire Bat Group and Yoredale Natural History Society); Gordon Haycock (Golder Associates); Sue Holmes (Wildlife Watch); Colin Howes (Doncaster Museum); Katherine Lart (C.M. Rob Natural History Society); Peter Lurz (University of Newcastle-upon-Tyne); John Messenger (Vincent Wildlife Trust); Sheila Metcalfe (C.M. Rob Natural History Society); Phil Prosser (Central Science Laboratory); Richard Thackrah (Whitby Naturalists); Alastair Ward (Central

Science Laboratory); Mark Williamson (University of York); The British Deer Society; Ryedale Naturalists. All data have been lodged with the North and East Yorkshire Ecological Data Centre (NEYEDC), whose co-operation in producing the maps is greatly appreciated. Colin Howes and Gordon Woodroffe kindly commented on an earlier draft of the paper.

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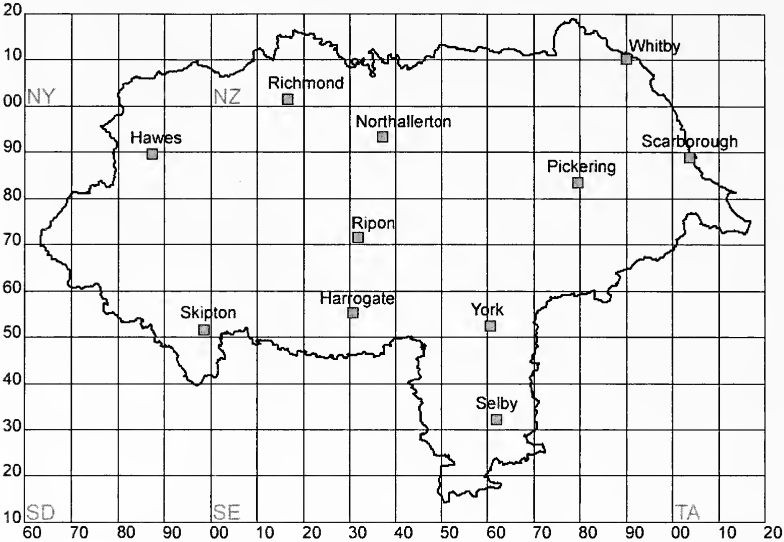

FIGURE 1.
Map of North Yorkshire showing the major towns.

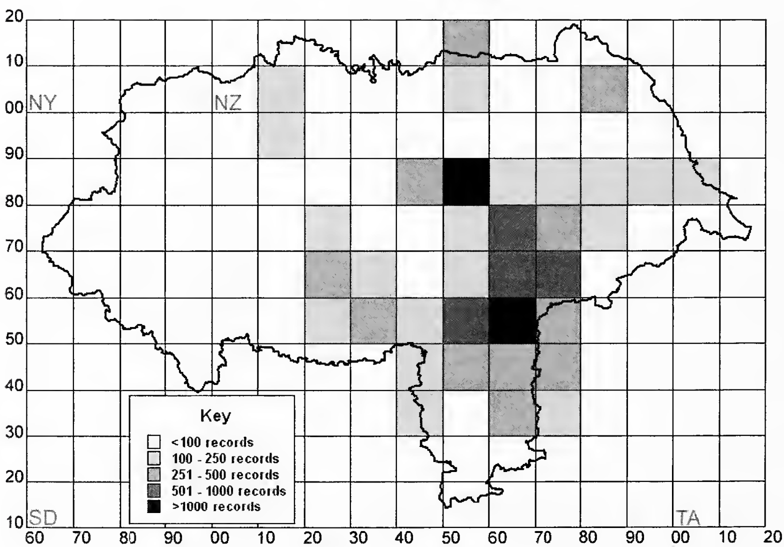

FIGURE 2
Number of mammal records from each 10 km grid square.

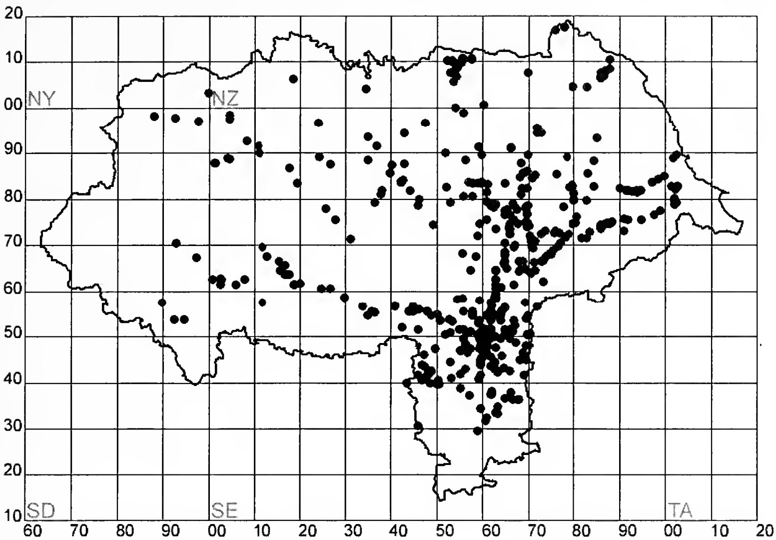

FIGURE 3.
Hedgehog *Erinaceus europaeus* L.

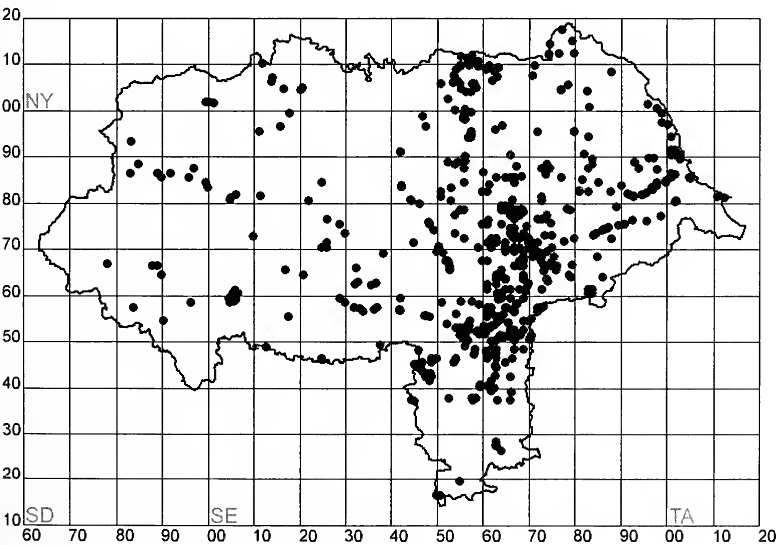

FIGURE 4
Mole *Talpa europaea* L.

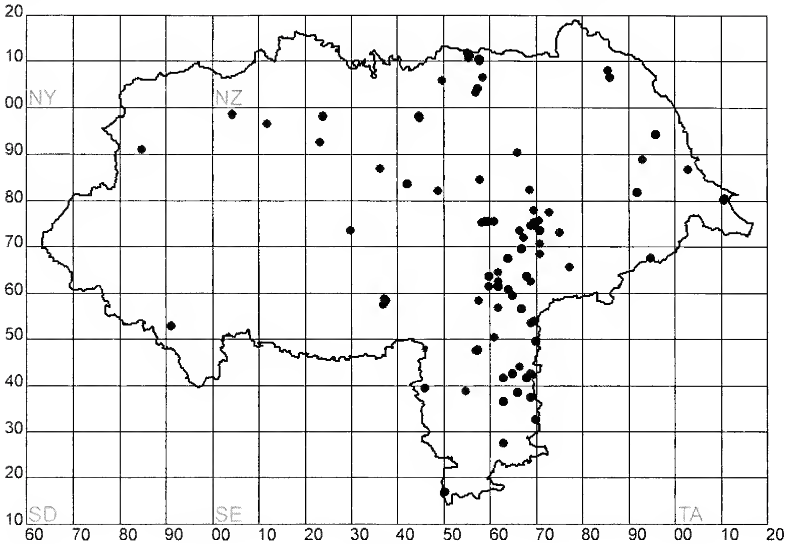

FIGURE 5
Common Shrew *Sorex araneus* L.

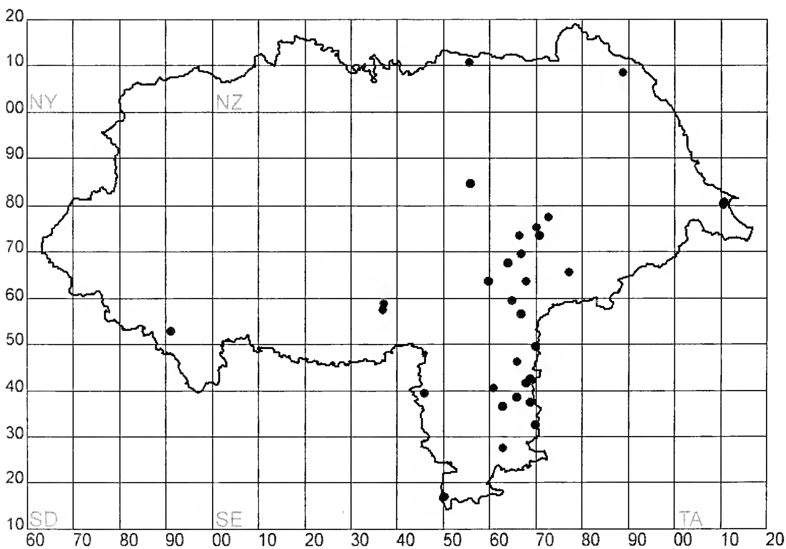

FIGURE 6
Pygmy Shrew *Sorex minutus* L.

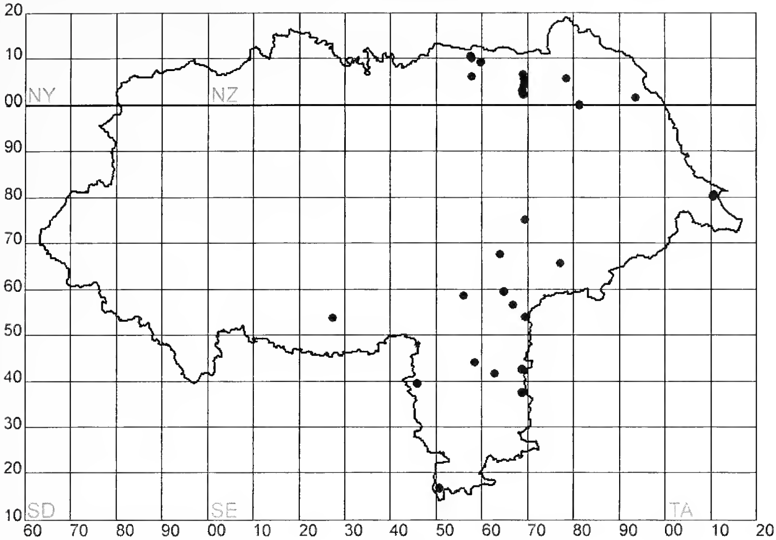

FIGURE 7
Water Shrew *Neomys fodiens* (Pennant)

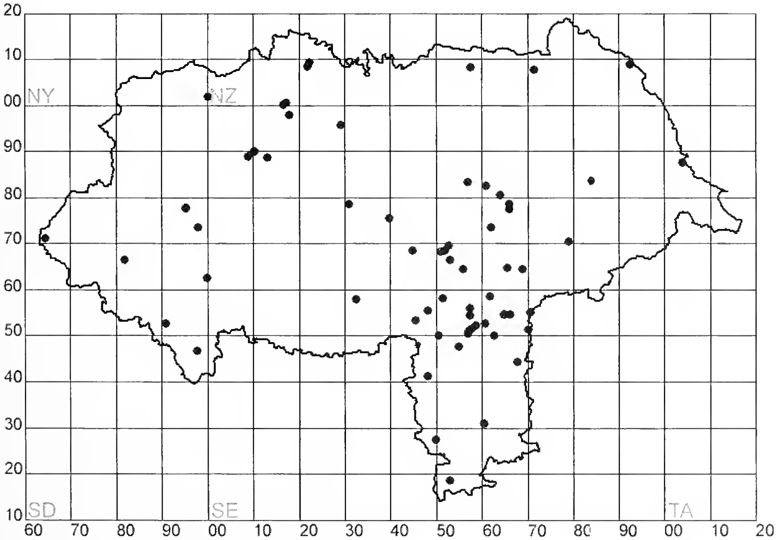

FIGURE 8
Whiskered Bat *Myotis mystacinus* (Kuhl) or Brandt's Bat *Myotis brandti* (Eversmann)

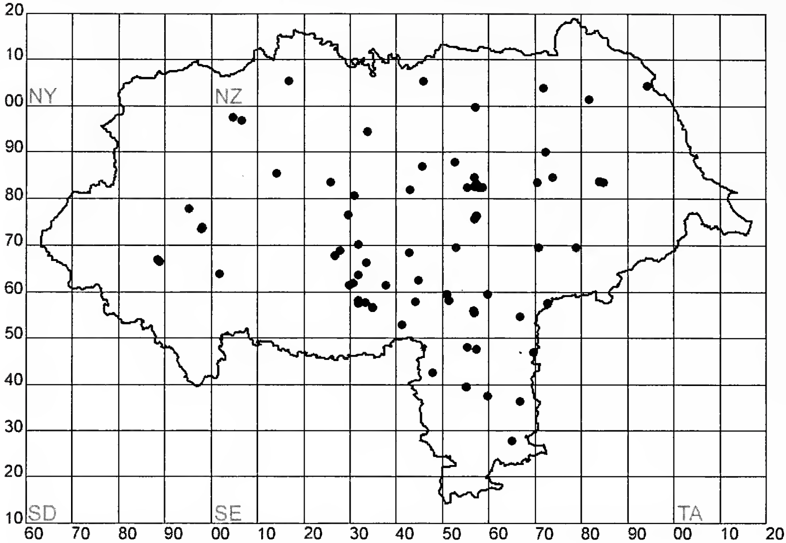

FIGURE 9
Whiskered Bat *Myotis mystacinus* (Kuhl)

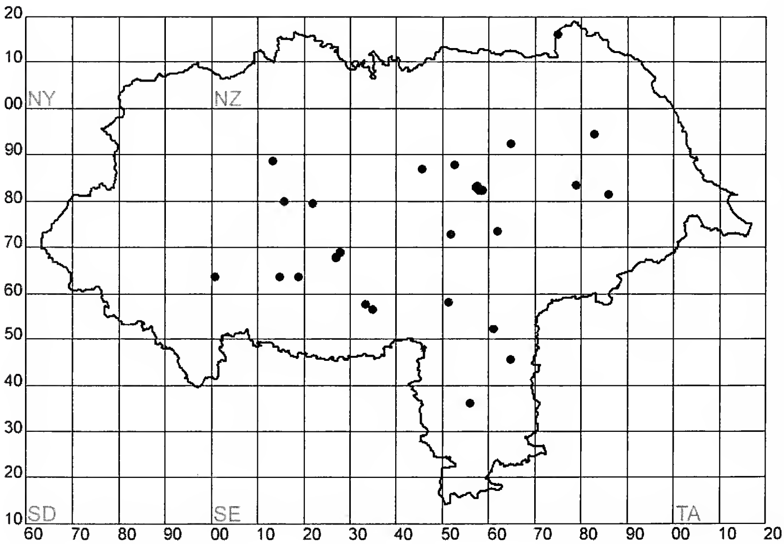

FIGURE 10
Brandt's Bat *Myotis brandti* (Eversmann).

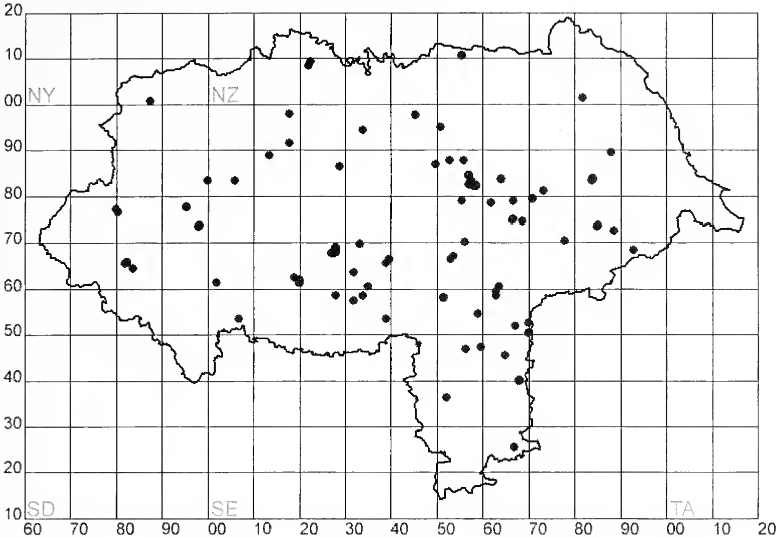

FIGURE 11
Natterer's Bat *Myotis nattereri* (Kuhl)

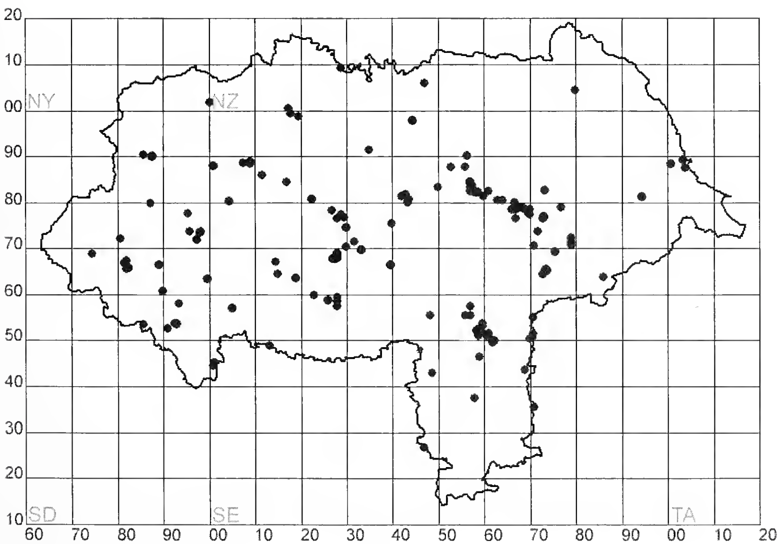

FIGURE 12
Daubenton's Bat *Myotis daubentoni* (Kuhl)

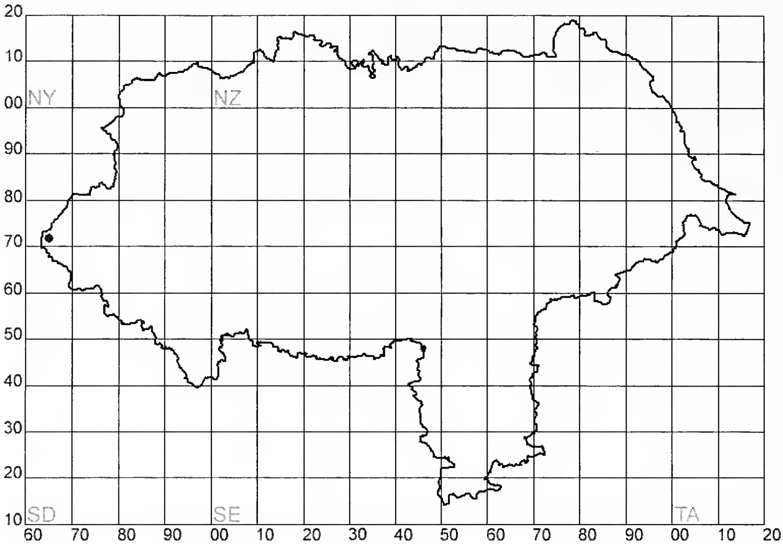

FIGURE 13
Leisler's Bat *Nyctalus leisleri* (Kuhl)

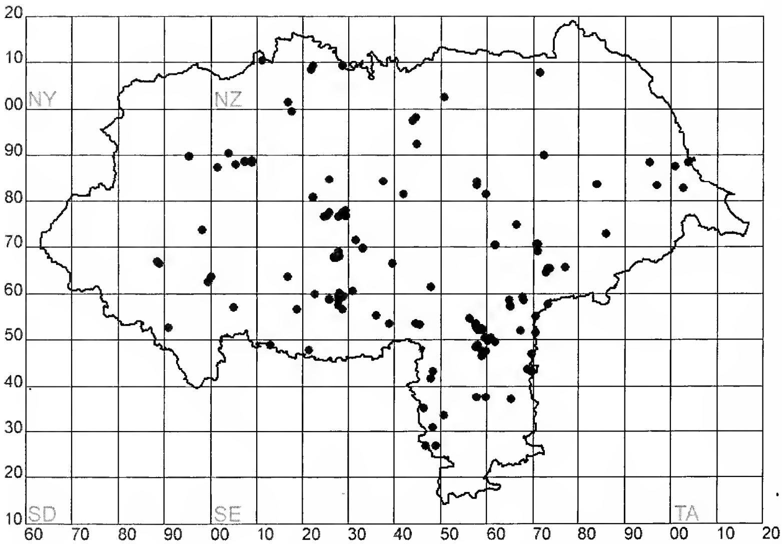

FIGURE 14
Noctule *Nyctalus noctula* (Schr.)

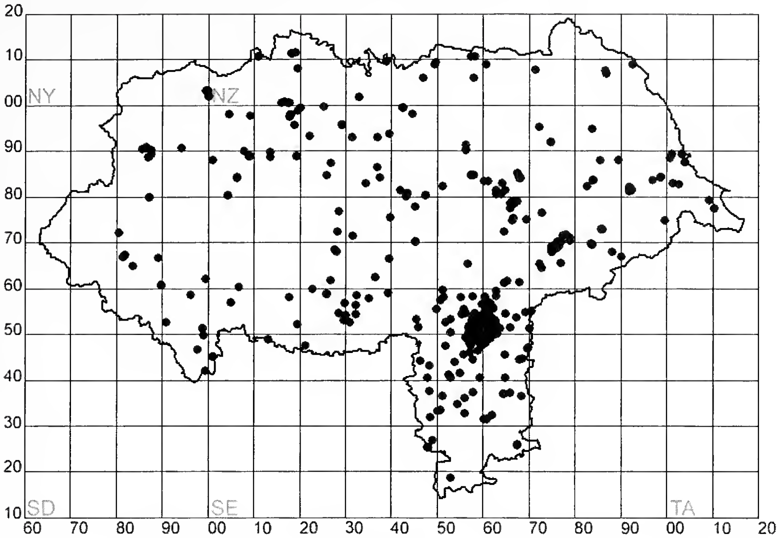

FIGURE 15
Common Pipistrelle *Pipistrellus pipistrellus* (Schr.)

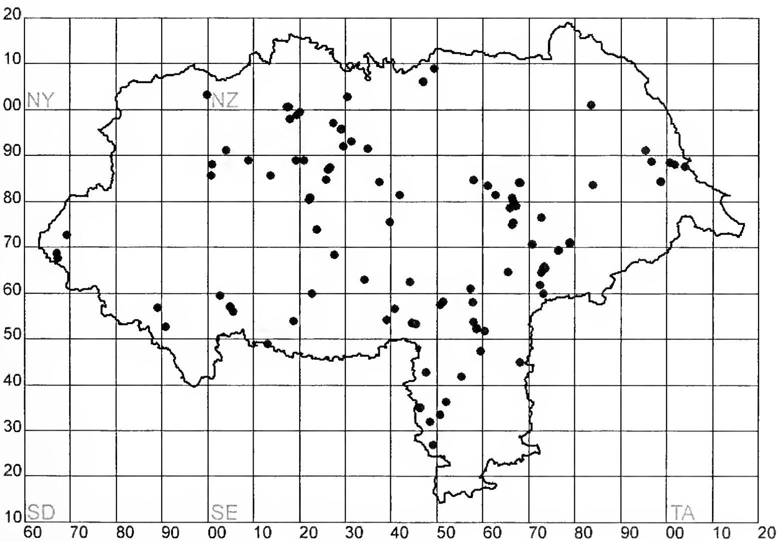

FIGURE 16
Soprano Pipistrelle *Pipistrellus pygmaeus* (Leach)

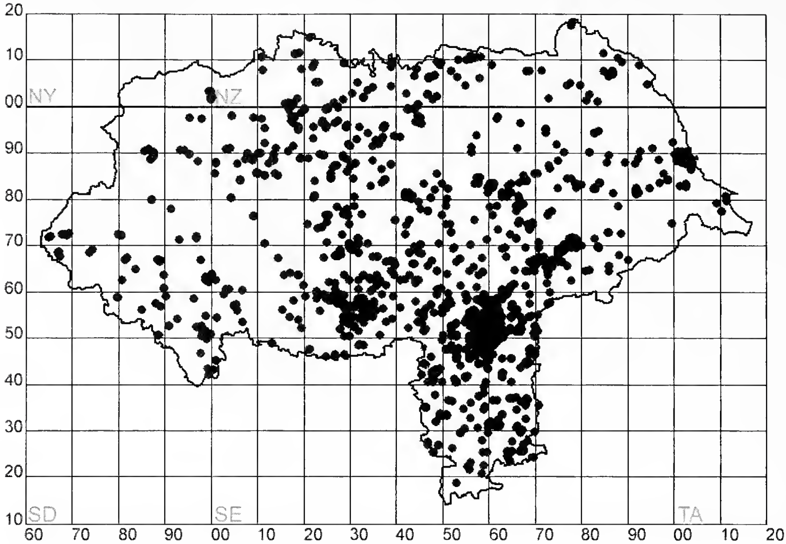

FIGURE 17
Common Pipistrelle *Pipistrellus pipistrellus* (Schr.) and
Soprano Pipistrelle *Pipistrellus pygmaeus* (Leach)

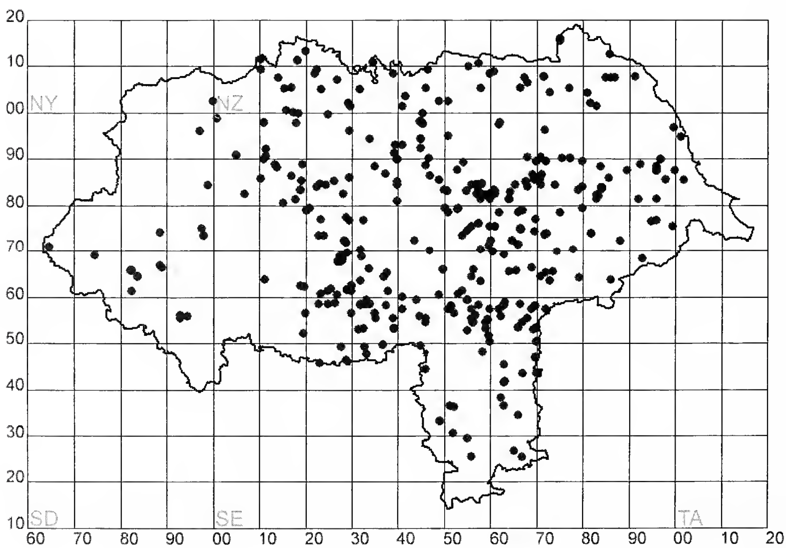

FIGURE 18
Brown Long-eared Bat *Plecotus auritus* (L.)

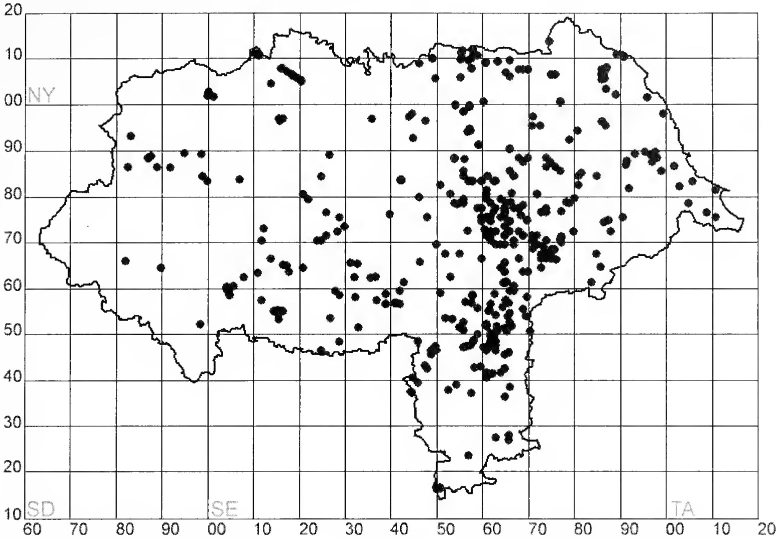

FIGURE 19
Rabbit *Oryctolagus cuniculus* (L.)

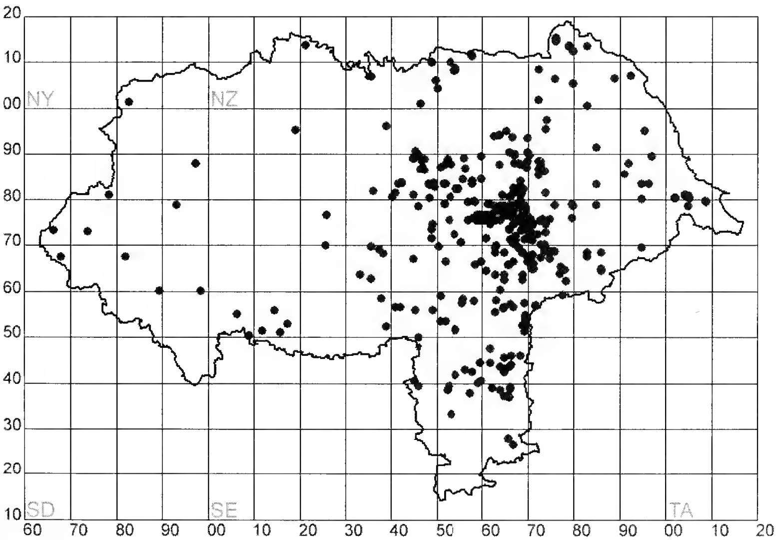

FIGURE 20
Brown Hare *Lepus europaeus* Pallas

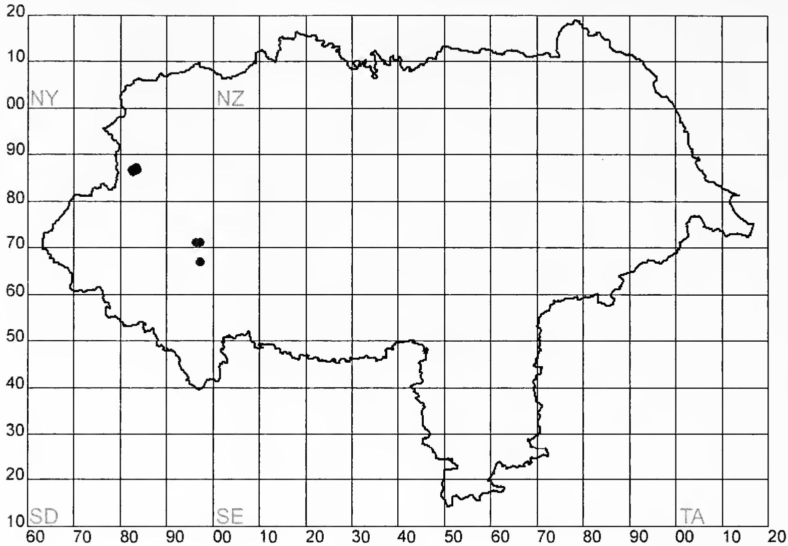

FIGURE 21
Red Squirrel *Sciurus vulgaris* L.

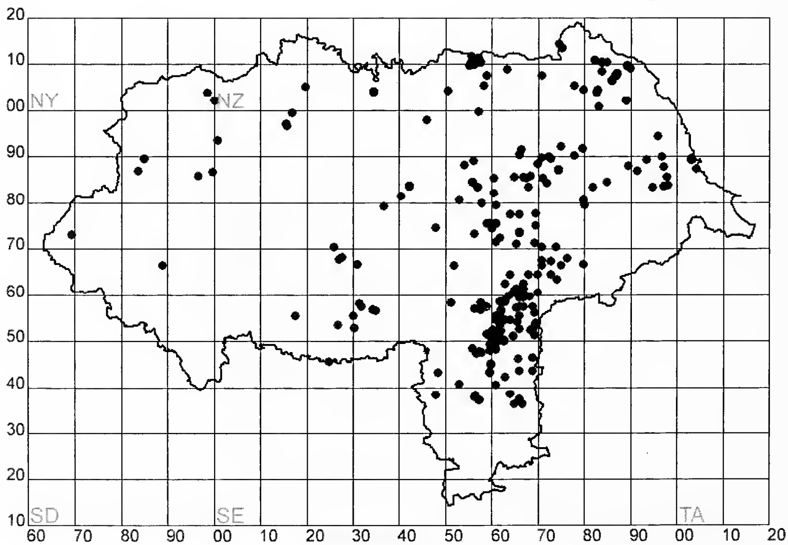

FIGURE 22
Grey Squirrel *Sciurus carolinensis* Gmelin

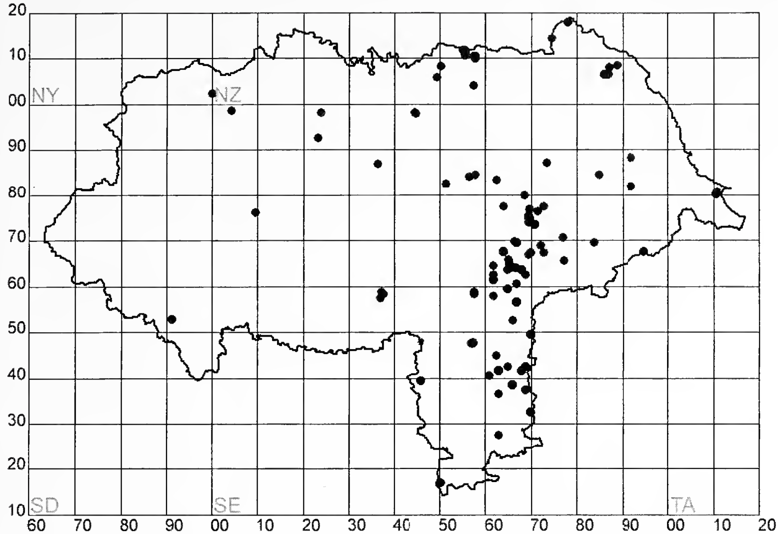

FIGURE 23
Bank Vole *Clethrionomys glareolus* (Schr.)

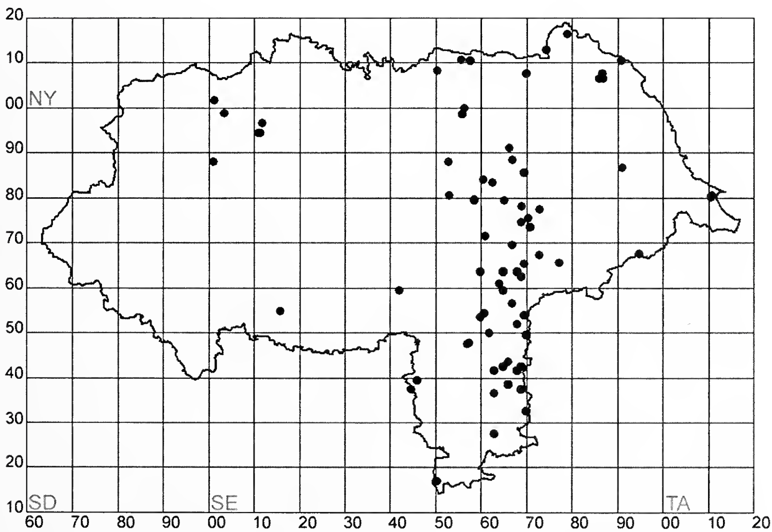

FIGURE 24
Field Vole *Microtus agrestis* (L.)

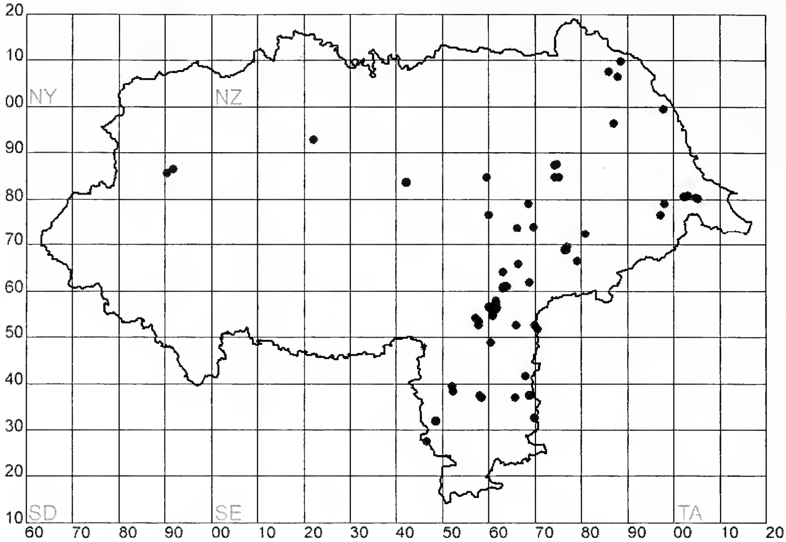

FIGURE 25
Water Vole *Arvicola terrestris* (L.)

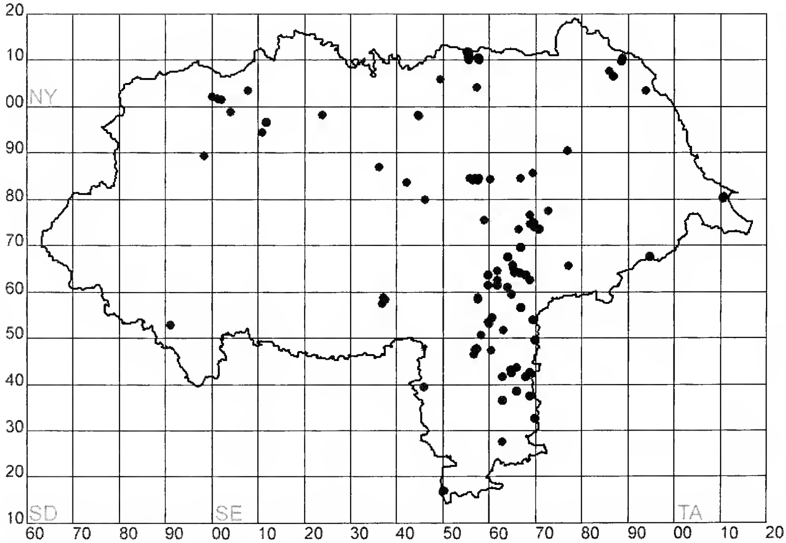

FIGURE 26
Wood Mouse *Apodemus sylvaticus* (L.)

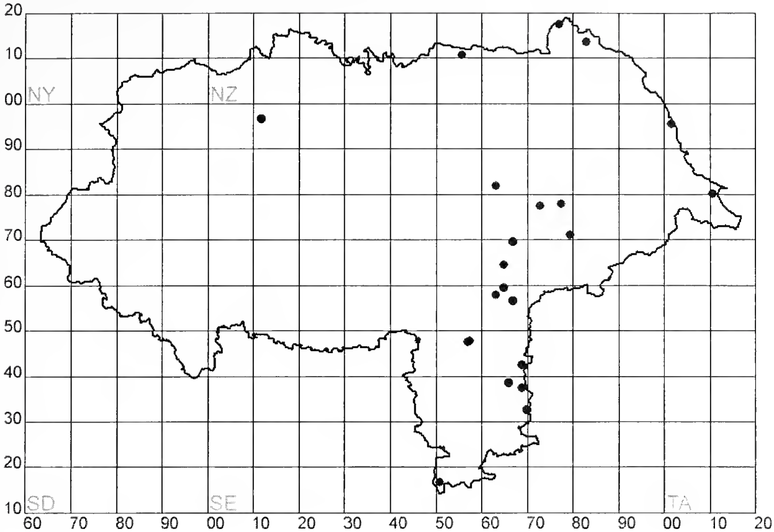

FIGURE 27
Harvest Mouse *Micromys minutus* (Pallas)

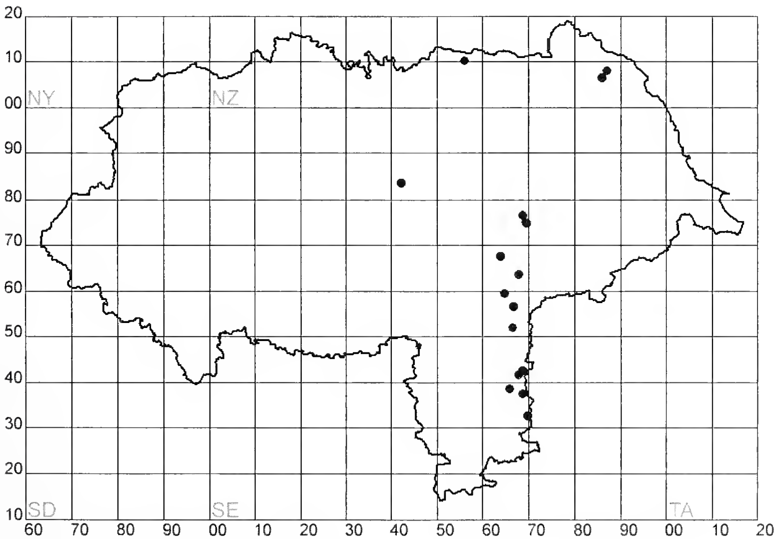

FIGURE 28
House Mouse *Mus musculus* L.

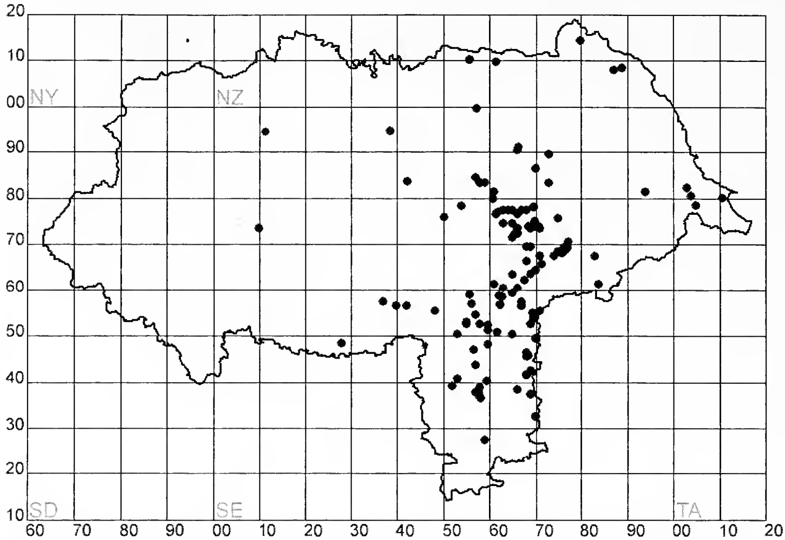

FIGURE 29
Brown Rat *Rattus norvegicus* (Berkenhout)

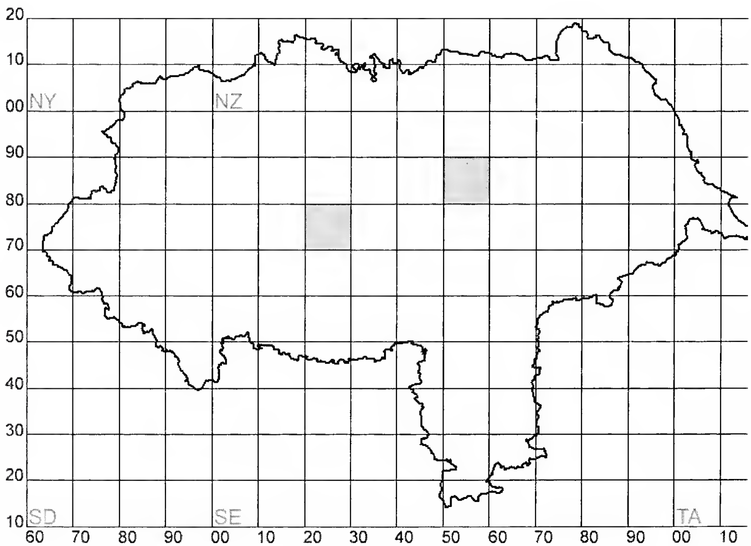

FIGURE 30
Dormouse *Muscardinus avellanarius* (L.)

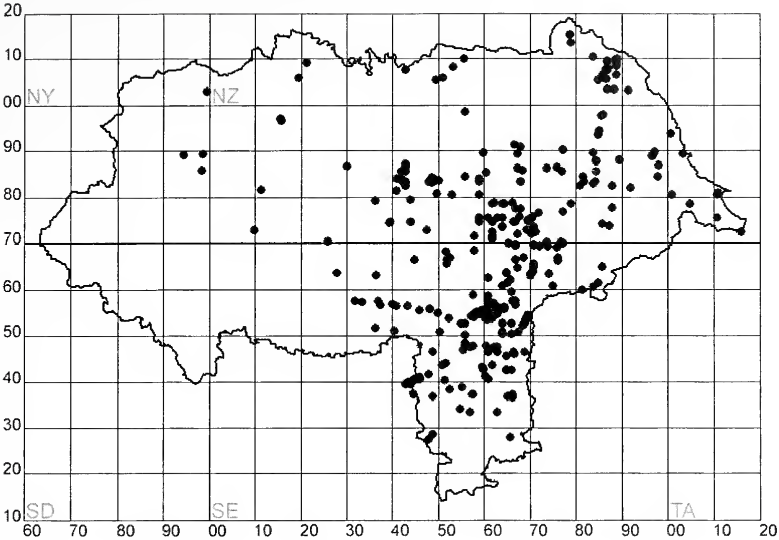

FIGURE 31
Fox *Vulpes vulpes* L.

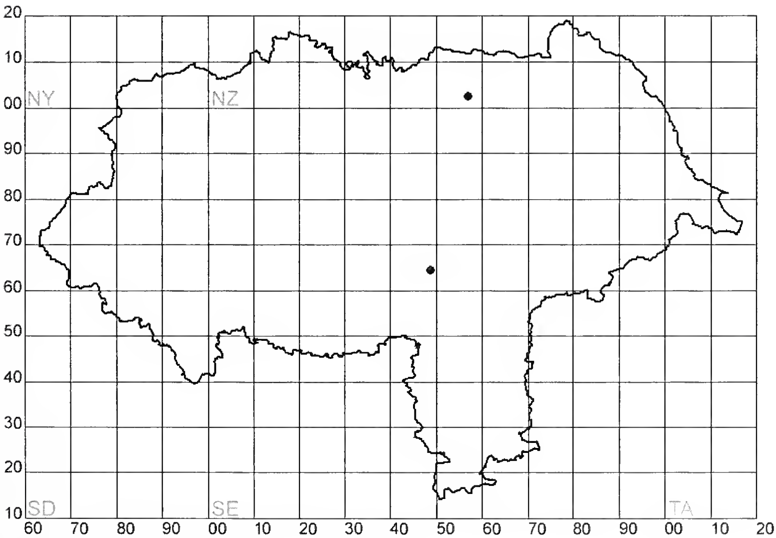

FIGURE 32
Pine Marten *Martes martes* (L.)

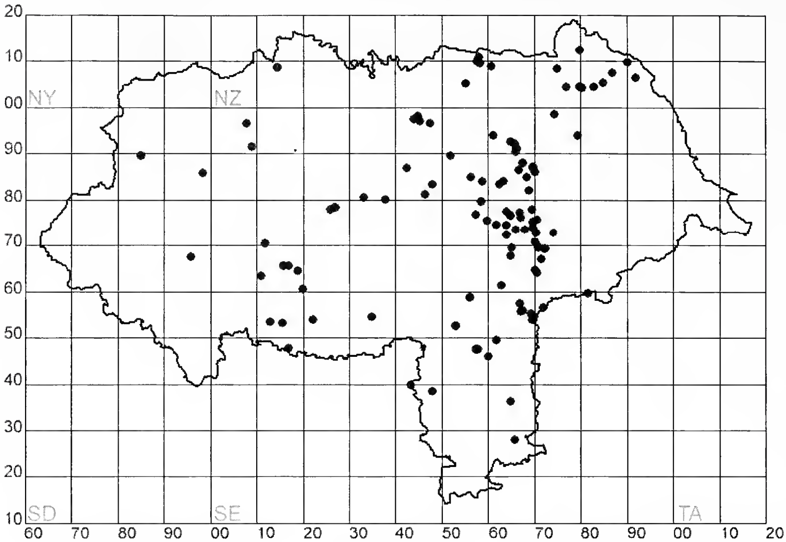

FIGURE 33
Stoat *Mustela erminea* L.

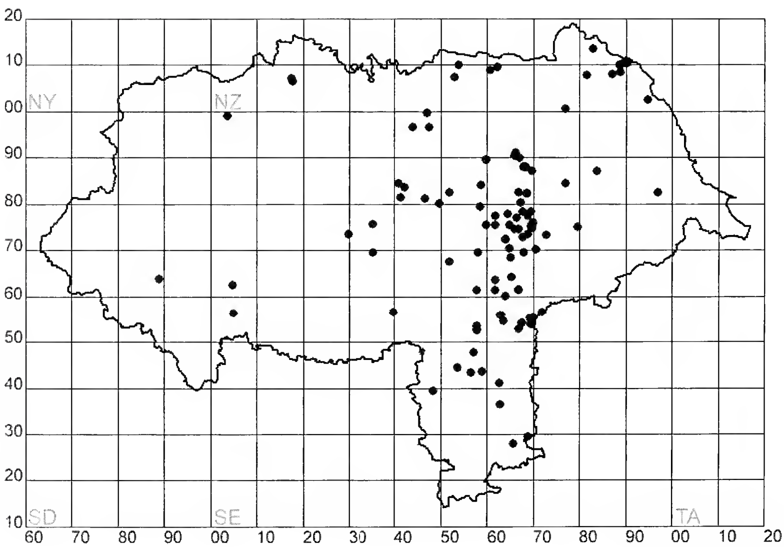

FIGURE 34
Weasel *Mustela nivalis* L.

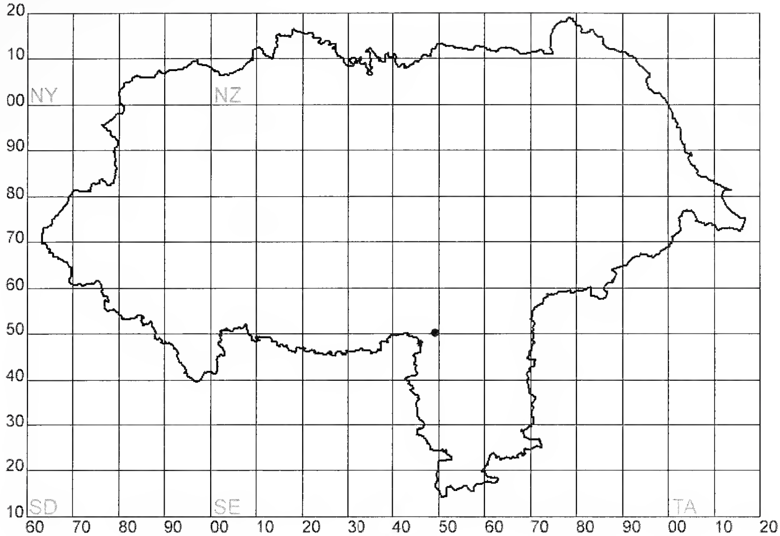

FIGURE 35
Polecat *Mustela putorius* L.

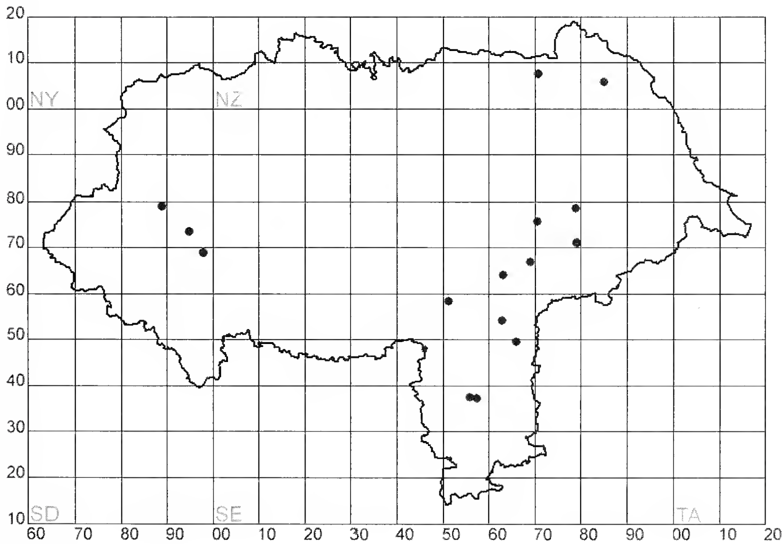

FIGURE 36
American Mink *Mustela vison* Schr.

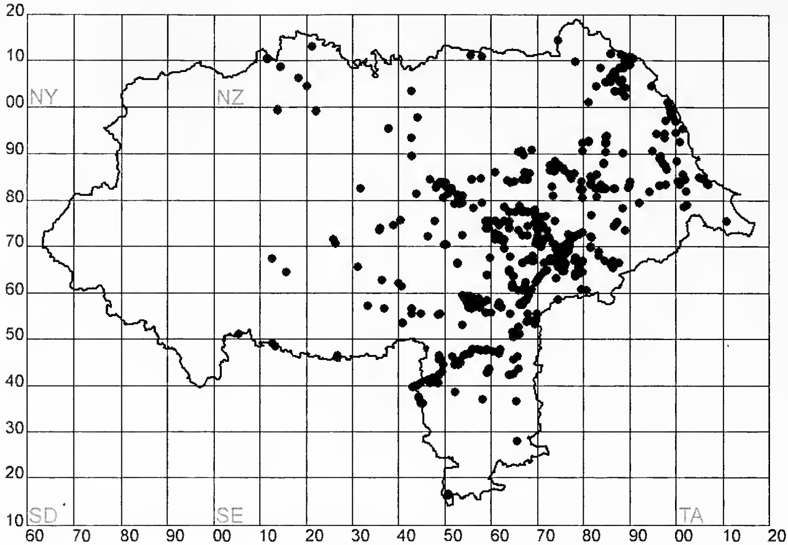

FIGURE 37
Badger *Meles meles* (L.)

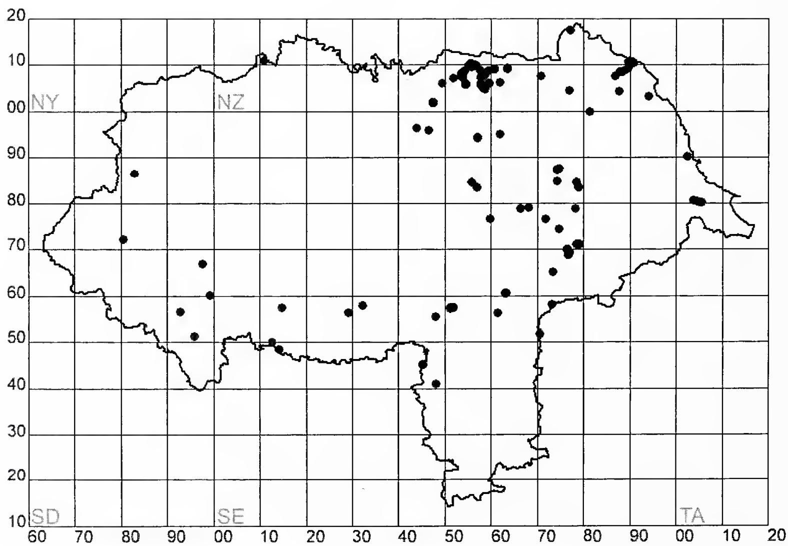

FIGURE 38
Otter *Lutra lutra* (L.)

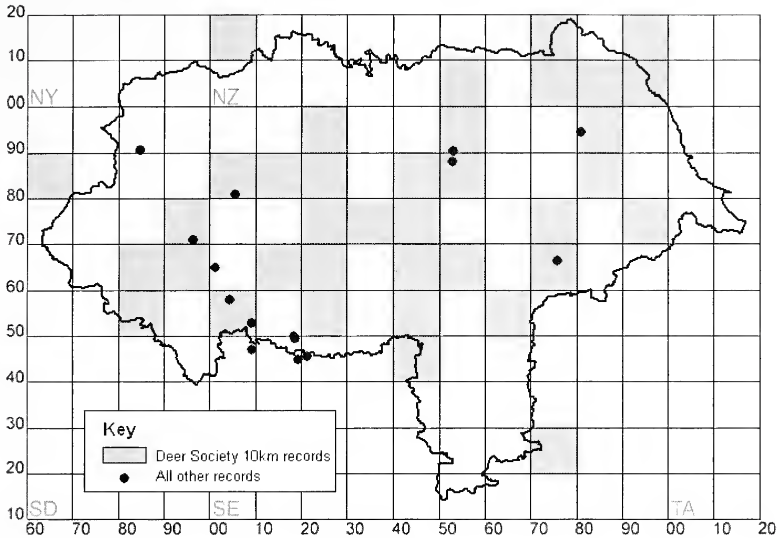

FIGURE 39
Red Deer *Cervus elaphus* L.

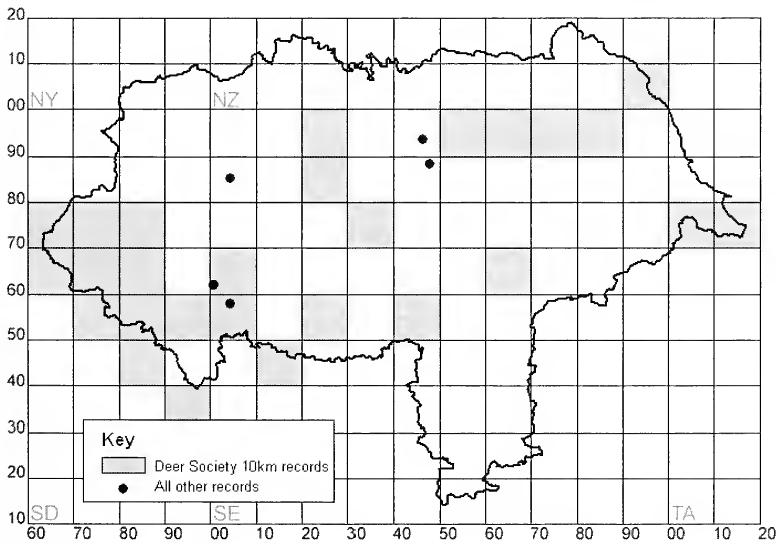

FIGURE 40
Sika Deer *Cervus nippon* Temminck

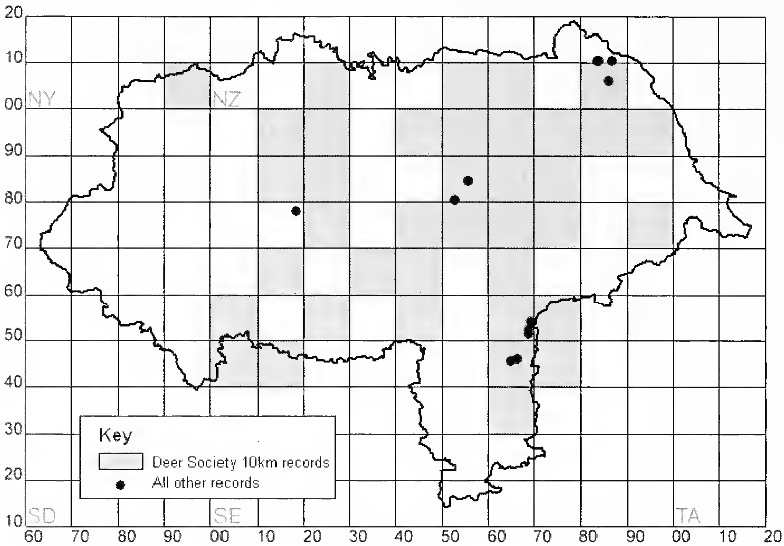

FIGURE 41
Fallow Deer *Dama dama* (L.)

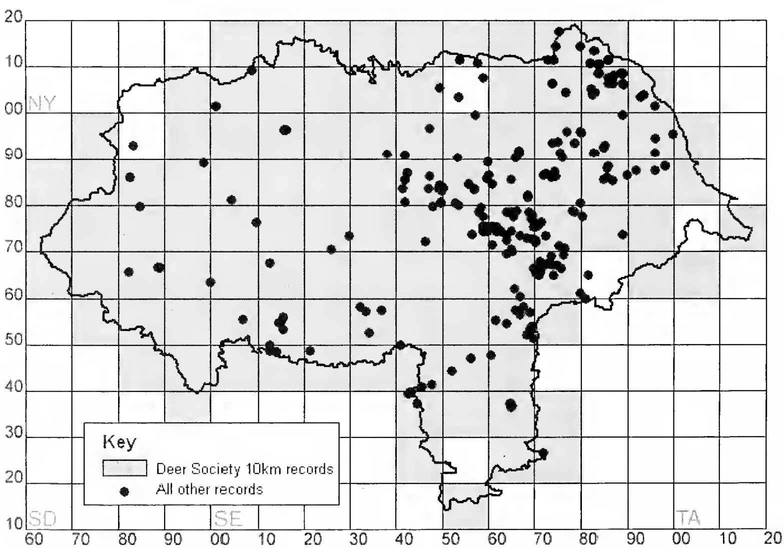

FIGURE 42
Roe Deer *Capreolus capreolus* (L.)

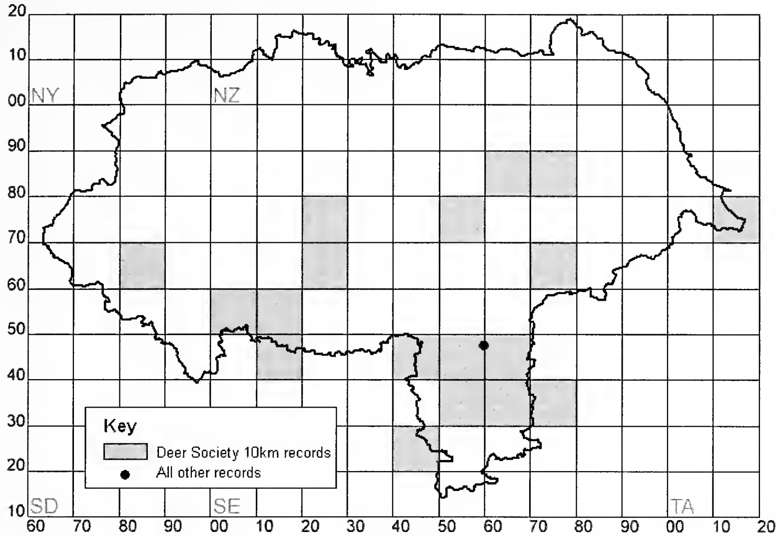

FIGURE 43
Muntjac *Muntiacus reevesi* (Ogilby)

BOOK REVIEWS

Illustrations of Alien Plants of the British Isles by **E.J. Clement, D.P.J. Smith** and **I.R. Thirlwell**. Pp. 478, with 444 pp. of line drawings. Botanical Society of the British Isles, London. 2005. £18.75 paperback, plus £5.00 postage from Summerfield Books, Brough, Cumbria. BSBI members pay a reduced rate.

The last quarter of a century has seen a dramatic increase in the numbers and variety of alien plant species colonising our islands, particularly in our urban areas, but also in the wider countryside, resulting from the effects of increasing human impact and other factors such as global warming. The landmark publication of *Alien Plants of the British Isles* by Eric Clement and Sally Foster in 1994 was the first attempt to classify and categorise over 4000 alien plant species which had been infiltrating our shores for a hundred years or more, and was much welcomed, filling a huge gap in our understanding and appreciation of these somewhat esoteric invaders.

The lack of illustrations of many of these alien species in any of the standard Floras prompted the need for a companion volume to *Alien Plants of the British Isles*. This omission has now been rectified by the appearance of the superbly produced present volume. There are 444 pages of beautifully executed black and white line drawings, by a number of skilled botanical artists, showing not just the whole plant portrait, but also detailed depictions of flower structure, fruits, leaf shape and other relevant characters to aid in identification. The layout of the book rigidly follows the checklist order in Stace's *New Flora of the British Isles* (1997), and each plant portrait is accompanied by the appropriate page reference in Stace.

There is precious little to find fault with, except, of course, to say that the book should have been three times as long and incorporated another 1000 species! I was particularly pleased to see that some of our famous West Yorkshire shoddy aliens get a few pages devoted to them – plants such as the alien *Erodium* species, the notoriously difficult *Amaranthus* family and some of the awkward grasses such as *Echinochloa colona* and the various *Hordeum* species.

This publication has been eagerly awaited by many of us for some time – we have not been disappointed! The book is a manageable size for taking in the field, and will be a valuable aid in identifying many of the strange looking plants we used, before, to conveniently avoid and pass by!

The authors and artists are to be congratulated on its production – it is to be hoped that the excellence of its presentation and layout will stimulate another batch of botanical artists to produce a second volume with another 400+ species in the years to come.

GTDW

Geology of the Lampeter district – a brief explanation of the geological map sheet 195, Lampeter by **J.R. Davies, D.I. Schofield, T.H. Sheppard, R.A. Waters, M. Williams** and **D. Wilson.** Pp. 34, with 13 coloured plates & figures. British Geological Survey/ NERC. 2007. £9.00.

Geology of the Llangranog district – a brief explanation of the geological map sheet 194, Llangranog by **J.R. Davies, D.I. Schofield, T.H. Sheppard, R.A. Waters** and **D. Wilson.** Pp. 38, with 15 coloured plates & figures. British Geological Survey/ NERC. 2007. £9.00.

[Each of these A5 booklets may be purchased with the appropriate, newly published 1:50,000 geological map (3-folded and cased) for £18.00 (a saving of £3.00 on purchasing the map and booklet separately) from: British Geological Survey, Keyworth, Nottingham NG12 5GG.]

These colourful and attractive publications provide a useful summary of the geological succession of parts of western Wales resurveyed in the mid- to late-1990s. There is a brief account of the depositional environment, character and subsequent history of each rock formation which incorporates concepts from the new structural model of the area developed in the early 1990s. The work also includes information on economic and environmental aspects of the area's geology, including water resources, mineral deposits, and geological hazards such as risks of landslides.

There is a fairly detailed section on glacial and periglacial features in the area which may appeal to geomorphologists and to physical geographers. This section is supported by maps and illustrations relating to the published 1:50,000 maps of the disposition of the Welsh and Irish Sea ice sheets and sections of glacial deposits.

Both publications provide excellent, up-to-date lists of references and there are several pages of information sources that are likely to prove of interest to anybody seeking to become acquainted with the character of these lesser known and fairly remote upland and coastal areas in southern Britain.

DEC

TAXIDERMISTS FROM THE EPWORTH DISTRICT OF NORTH LINCOLNSHIRE

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Museum & Art Gallery, Chequer Road, Doncaster DN1 2AE

Introduction

During the course of my research on 18th and 19th century taxidermists in the Doncaster district of South Yorkshire, information has also accrued from the nearby Epworth district, over the county boundary in North Lincolnshire. It is the purpose of this short paper to put on record the data gathered from this outlying part of Lincolnshire, as a contribution towards any future account of the county's taxidermists and their work.

Epworth is best known as the childhood home of John and Charles Wesley. Lying between Doncaster and Scunthorpe, and west of the River Trent, it was a small, straggling market town in the mid-19th century. At the 1851 census, the population was put at 1944, rising to 2295 by 1871. Another market town, Crowle, lay six miles to the north. Epworth's immediate hinterland, a part of the Isle of Axholme, was essentially rural, dominated by the cultivation of potatoes, grain and flax. However, with riverine, estuarine, woodland, peatland and other habitats in the region, there was clearly potential for at least part-time taxidermists to be numbered amongst the residents of the district. Four such men have been traced, only one of whom featured as a taxidermist in a contemporary trade directory.

Henry Gravil

The most significant of the Epworth district taxidermists is Henry Gravil. His parents, Richard Gravil, an Epworth labourer,[1] and Elizabeth *née* Freeman, were married on 15 August 1796.[2] Henry, the youngest of eight children,[3] was baptised at St Andrew's, Epworth, on 3 February 1821.[4] Census returns for 1841-1901 record him as successively "Ag[ricultural]. Lab[ourer], "Overlooker of Highways", "Surveyor of Roads", "Overseer of Roads", "General Labors [*sic*]", "Gardener &c" and "Kennel Keeper Groom". The Epworth marriage registers covering 1841[5] and 1851[6] record Henry as a "Labourer", as does the birth certificate of his son John Freeman Gravil (*q.v.*), born 2 January 1854.[7] The burial register recording Henry's death in 1902[8] describes him as "Kennel Keeper to Dr Melville and formerly Foreman of Highways".

On 12 October 1841, at St Andrew's, Epworth, Henry Gravil married Mary Ann Standring,[9] daughter of Richard Standring, an Epworth farmer. They had three children, born 1845-50.[10] Mary Ann died on 2 December 1850 at the early age of 27, though her death was not a result of childbirth.[11] At the 1851 census, Henry's household included Sarah Ann Clark – born in nearby Haxey – as housekeeper. Sarah was then aged 18, and on 18 August that year she and Henry were married at St Andrew's.[12] They had eight children, born 1852-70,[13] including John Freeman Gravil (*q.v.*). Henry died on 17 December 1902 and was buried at St Andrew's,[14] but Sarah survived for a further 13 years.[15]

Nowhere in the allusions to Henry Gravil's occupations is there any reference to taxidermy. Nor does he appear as such in any trade directories. It must therefore have been a sideline, but presumably a commercial one. References to his taxidermy span the 1860s, and it is therefore reasonable to suppose that his interest extended into at least the decade on either side.

The first evidence is a note which appeared in the *Doncaster Gazette* and *Doncaster Chronicle* in 1860.[16] This records that an inhabitant of Kelfield, by the River Trent, had shot an Osprey *Pandion haliaetus* with a fish in its talons. The bird was "sent to Mr. Henry Gravel's [*sic*], Epworth, for preservation". In 1862 in the *Doncaster Gazette*[17] it was stated, apparently by Samuel Hudson (*q.v.*), that a Peregrine Falcon *Falco peregrinus* had recently been shot on Read's Island in the Humber, and was in the possession of Henry Gravil. In 1864, Samuel Hudson published a note in *The Zoologist*[18] concerning an Epworth man who had shot an unidentified wader in September of that year. It was "taken by him to

Mr. Gravil, birdstuffer, of the same place, who said it was the spotted sandpiper (Totanus macularius) [*Actitis macularius*]"; however, claims of this species, including the Epworth bird, were examined by J.H. Gurney Jun.,[19] who dismissed the latter as unreliable. In the same year, the *Doncaster Gazette* and *Doncaster Chronicle* of 2 December reported that a Fox *Vulpes vulpes*, shot near Epworth, was "now in the hands of Mr. H. Gravel [*sic*], for preservation". In late May 1865, a Badger *Meles meles* captured at Epworth "was sent to Mr. H. Gravil, of Epworth, for preservation".[20] Later in that year, the *Doncaster Gazette* and *Doncaster Chronicle*[21] reported that an inhabitant of Wroot, to the west of Epworth, had shot a "ring-necked pheasant [*Phasianus colchicus torquatus*]". "This bird is now to be seen at Mr. Henry Gravel's [*sic*], where it has been sent for preservation", the wording strongly suggesting some kind of premises. Also in 1865, Henry Gravil himself reported in *The Zoologist*[22] the occurrence of both Peregrine Falcon and Merlin *Falco columbarius* in the Epworth district. The former he had received on 27 February "in the flesh", describing it as "my specimen". Finally from 1865, Samuel Hudson recorded in *The Zoologist*[23] a Bittern *Botaurus stellaris* from near Epworth, "placed in the hands of Mr H. Gravil, of Epworth, for preservation". In the autumn of 1869, and again from Read's Island, a Glossy Ibis *Plegadis falcinellus* was "received in the flesh by Mr. Gravil, of Epworth".[24] This specimen subsequently went to the collection of J.H. Gurney Jun.[25]

Puzzlingly, and also in 1869, five notes appeared in *The Zoologist*,[26] which although attributed to J.F. Gravil Jun., seemingly one of Henry Gravil's sons, must have been written by Henry, as at the beginning of that year John Freeman Gravil would have been only 15 years old. The notes record Bitterns and several raptors from the Epworth neighbourhood, all apparently received for taxidermy. Most significantly, in the first of the notes, "J.F. Gravil, jun." commented that an Osprey had been brought to him on 5 December 1868, and added, presumably referring to the Kelfield bird, "This is the second specimen I have received during the last five years; the first was shot on the banks of the River Trent, in the act of devouring a large fish". The writer of which has to be Henry Gravil, but the reason for his seeming anonymity is unknown. There is no independent evidence that John Freeman Gravil was ever a taxidermist.

There are three notes in the *Doncaster Gazette* and *Doncaster Chronicle* from the Epworth district in the 1860s which *may* have involved Henry Gravil, but which did not actually name a taxidermist. In 1861,[27] a farmer had a stillborn calf with two heads; the owner "has sent the heads to be stuffed for preservation". A Pine Marten *Martes martes* was killed, allegedly in 1864, at Westwoodside, to the SW of Epworth. "The animal is now stuffed, and in possession of a person at Misson",[28] close to Bawtry. The year in question is open to some doubt.[29] Finally, it was recorded in 1865[30] that "Mr. George Addey, of Epworth, has recently made an addition to his museum of stuffed birds and beasts". The museum was a mixture of locally obtained specimens such as a Short-eared Owl *Asio flammeus*, foreign species (some from travelling menageries, including a "Coati-Monday [*Nasua*]") and "several other curiosities of nature, an inspection of which will amply repay a visit". Regrettably, there is no evidence to suggest whether George Addey acted as his own taxidermist or employed the services of others.

Samuel Heaton Hudson

Samuel Heaton Hudson was baptised at Epworth on 13 May 1827.[31] His parents were William Hudson and Elizabeth *née* Heaton, his mother being a native of Winterton, N of Scunthorpe. They were married at Epworth on 11 July 1817.[32] William was characterized in Samuel's baptismal entry, census returns and trade directories as having a school in Epworth, though he was later listed as a land surveyor. William Hudson apparently died relatively young, in the 1840s. He and his wife had six children, all born in Epworth,[33] with Samuel being the third. The latter had three brothers, the youngest of whom, also William, wrote a note on Goosander *Mergus merganser* near Epworth[34] and may have been interested in Lepidoptera.[35] Samuel Hudson never married, and died in Epworth on 7 April 1904.[36]

Reflecting his diverse talents, Samuel Hudson's occupations formed a somewhat varied career, as recorded in census returns and trade directories. Throughout his working life, Hudson was often alluded to as a tailor, but he also had other occupations, sometimes in combination with each other, sometimes with tailoring. These included photographer, painter and "Accountant". Samuel and members of his family were involved with the Epworth Mechanics' Institute. His other interests included the Epworth Horticultural Society and the Epworth Poultry and Dog Show (subsequently the Epworth Agricultural Show),[37] at which the *Doncaster Gazette* of 15 May 1868 recorded Samuel as a cage-bird judge.

In natural history, Samuel Hudson's interests ranged over ornithology, Lepidoptera and latterly botany.[38] It is as a botanist that he is most readily recalled today, warranting a brief entry in Desmond.[39] The earliest evidence of Samuel's interest in ornithology is a letter to the *Doncaster Gazette* of 28 December 1862, recording some of the rarer birds of the Epworth neighbourhood. During the remainder of the 1860s, Samuel contributed a number of ornithological notes to *The Zoologist* and *The Field*.[40] His writing reveals that sometimes he could be uncritical in his approach to bird identification and the claims of others, though this latter is not surprising for a working man at that time. It is also known that Samuel was interested in oology: alongside his Lepidoptera at the Epworth Agricultural Show of 1869, he exhibited a collection of "British and other birds' eggs".[41] Following the death of Samuel in 1904, F.A. Lees wrote of him:

> He was a fine example of the labouring-man naturalist; showing at once the widest sympathies with nature in the best sense, and the difficulty of working without books and a proper training. He was over 77 years of age, and so was a youth before the advent of village schools, with no education except what his own industry and native talent had striven for. A natural gift for quick and minute observation was highly developed in him.[42]

As the son of a schoolmaster, Samuel's unpromising start in life is surprising.

Samuel Hudson was interested in taxidermy. Hence perhaps his recorded friendship with the renowned Doncaster taxidermist and natural history dealer Hugh Reid, whom he characterized as "my venerable and esteemed friend".[43] Whether Samuel was involved commercially with taxidermy is not clear as there is little evidence. In 1865, a specimen of Great Spotted Woodpecker *Dendrocopos major*, obtained near Westwoodside, was "sent to Mr. Samuel Hudson, naturalist, of Epworth, for preservation".[44] In writing to the *Doncaster Gazette* of 10 December 1869, Samuel wrote that an adult male Rough-legged Buzzard *Buteo lagopus* had been "trapped near here and sent to me for preservation on Saturday, Nov. 20th". The *Doncaster Gazette* and *Doncaster Chronicle* of 21 September 1883 noted the capture of a Hoopoe *Upupa epops* on 14 September at Newland, between Epworth and the Trent. It was described as "now in the hands of a bird-stuffer". Was this Samuel Hudson? It is known that he was still active in that decade, as he recorded taking in a specimen of Pallas's Sandgrouse *Syrrhaptes paradoxus* during the great incursion of that species in 1888. On 23 May in that year, a male Sandgrouse was shot from a flock of five near Epworth, "and brought to me for identification".[45] An item in the *Doncaster Gazette*[46] stated that the specimen "is now at Mr. S. Hudson's, Epworth, for preservation".

This latter quotation seems to imply that Samuel Hudson had some kind of premises, but like Henry Gravil, these may only have been his house. Samuel knew Henry Gravil (they even lived next door to each other when aged 14 and 20 respectively),[47] and it is possible that Samuel obtained taxidermy instruction from him. Samuel sometimes lamented the loss and destruction of rare birds, and this could infer that he was not involved in "bird-stuffing" in a significantly commercial way. Hugh Reid is not known to have ever lamented their destruction.

William Cole/Cox

Owston Ferry lies close to the River Trent, SW of Epworth. Under the heading for this village, White's *Directories* refer to William Cole in 1882[48] and William Cox in 1892-93,[49] on both occasions as a "painter, paperhanger and taxidermist".

John Fletcher

In White's *Directory* for 1872,[50] "J. Fletcher" is included as a watchmaker and photographer in Owston Ferry. Significantly, Kelly's *Directory* for 1885[51] gives John Fletcher as a watchmaker in High Street, Crowle, where business opportunities must have been better. In White's *Directory* for 1892-93,[52] John Fletcher is listed as a "Watch cleaner and shopkeeper" of South End, Crowle. In January 1886, a Bittern was forwarded to John Fletcher, "taxidermist, Crowle".[53] This is presumably a further reference to the same man, and his taxidermy, like photography, was obviously subsidiary to his skill with watches.

Acknowledgements

For elements of the information used in this paper, I am grateful to my colleague C.A. Howes, and also to Andrea Marshall of The Friends of the Doncaster Museums. Access to copies of *The Zoologist* was facilitated by Philippa Strang at the Yorkshire Museum, York.

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27. *Doncaster Chronicle*, 29 November.
28. *Doncaster Chronicle*, 7 June 1867.
29. The *Doncaster Gazette* of 2 June 1865 reported the occurrence of a Pine Marten in the Isle of Axholme in 1862. Subsequently, in a detailed report on the Thorne Agricultural Show of June 1868, which appeared in the *Doncaster Gazette* of 19 June, it was observed: "Mr. Brooke, of Northwith Hill, Bawtry, also exhibited specimens of Pine Martin, shot at Westwoodside in 1863, and a specimen of the Large Moor Hawk [presumably Marsh Harrier *Circus aeruginosus*], shot on Hatfield Moors fifty years ago". Despite the discrepancies in year, the foregoing may have involved, at least in part, the Pine Marten alluded to in the *Doncaster Chronicle* in 1867.
30. 22 December.
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RECORDER'S NINTH REPORT OF THE ACULEATE HYMENOPTERA IN WATSONIAN YORKSHIRE

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Since my last report (Archer, 2004), three new species and one re-discovered species have been found in Watsonian Yorkshire. In the following account, recorders are identified by the initials: A.N. Abramson (ANA), M.E. Archer (MEA), H.E. Beaumont (HEB), J.D. Coldwell (JDC), W.A. Ely (WAE), J. Flanagan (JF), W.J. Fordham (WJF), K. Rutter (KR), D. Whiteley (DW), D.R. Walburton (DRW), H. Whiteley (HW).

NEW SPECIES:
Diodontus insidiosus Spooner, Blaxton Common 2 (SE60), MEA, July 2006. *Passaloecus eremita* Kohl, Sand Hutton (SE65), MEA, July2004. *Cerceris rybyensis* (L.), Blaxton Common 2, MEA, Aug. 2004, Aug. 2005.

RE-DISCOVERED SPECIES:
Lasioglossum lativentre (Schenck), Hatfield Moor (SE70), MEA, July 2006. The only previous literature record is from Allerthorpe Common (SE74), WJF, May 1927. The species was considered extinct in Archer (2002).

OTHER IMPORTANT RECORDS:
Aphelopus nigriceps Kieffer, Wath (SE40), WAE, June 2004.
Methocha articulata Latreille, Allerthorpe Common, (SE74), MEA, July 2004.
Priocnemis susterai Haupt, Dovecliffe (SE30), JDC, May 2006.
Anoplius infuscatus (Vander Linden), Blaxton Common2 (SE60), MEA, June 2004, Aug. 2004, July 2005, June 2006; Hatfield Moor (SE70), MEA, Aug. 2005, July 2006.
Dolichovespula saxonica (Fab.), Baildon (SE14), HW, May 2004; Elm Moor Lake (SE65), MEA, July 2006; Sandall Beat Wood (Pot Hill) (SE60), MEA, July 2006.
Tachysphex nitidus (Spinola), Blaxton Common 2 (SE60), MEA, June 2004, June 2006.
Crossocerus leucostomus (L.), Strensall Common (SE66), MEA, June 2005, June 2006.
Pemphredon morio Vander Linden, Strensall Common (SE66), MEA, July 2006.
Argogorytes fargeii (Shuckard), Flamborough Head (TA26), MEA, June 2005.
Cerceris arenaria (L.), Blaxton Common 2 (SE60), MEA, July, Aug. 2004, July, Aug. 2005, July 2006; Sandall Beat Wood (Pot Hill) (SE60), MEA, July 2006.
Philanthus triangulum (Fab.), Blaxton Common 2, MEA, July, Aug. 2004, July, Sept. 2005, July 2006; Hatfield Moor (SE70), MEA, July 2006; Wombwell (SE30), JDC, 2006.
Andrena praecox (Scopoli), Blaxton Common 2 (SE60), MEA, April 2004, April 2005; Strensall Common (SE66), MEA, April 2004, May 2004.

Andrena ruficrus Nylander, Allerthorpe Common (SE74), MEA, May 2006.

Andrena tibialis (Kirby), Blaxton Common 2 (SE60), MEA, April 2004; Sand Hutton (SE65), MEA, April 2005.

Sphecodes crassus Thomson, Allerthorpe Common (SE74), MEA, June 2006, Blaxton Common 2 (SE60), MEA, May 2004, June 2005; Hole of Holcum (SE89), MEA, June 2005; Millington (SE85), MEA, July 2005.

Sphecodes ferruginatus von Hagens, Rotherham (SK58), WAE, Aug. 2000; Strensall Common (SE66), MEA, July 2006.

Sphecodes reticulatus Thomson, Allerthorpe Common (SE74), MEA, July 2006; Blaxton Common 2 (SE60), MEA, Aug. 2004, Sept. 2006.

Anthidium manicatum (L.), Armthorpe (SE60), JTB, June 2005; Clifton Backies (SE55), MEA, June 2005; Cotleigh (SK48), DRW, Crystal Peaks Meadow (SK48), DW, July 2005; Hull (TA03), ANA, Aug. 2004; Upperthorpe (SK38), KR, July 2004.

Coelioxys inermis (Zetterstedt), Strensall Common (SE66), MEA, July 2005.

Coelioxys rufescens Lepeletier & Serville, Tong Park (SE13), HW, June 2004.

Nomada flava Panzer, Baildon (SE14), HW, June 2006; Blaxton Common 2 (SE60), MEA, June 2006; Denaby Ings (SE40), HEB, May 2005; Ivy Lodge Plantation (SK58), DW, May 2005; Lindrick Golf Course (SK58), WAE, May 2000; Oakbrook Ravine (SK38), DW, May 2005; Salt Marsh Delph (SE72), May 2006; Sheffield (SK39), JF, May 2006; Strensall Common (SE66), MEA, May 2006, June 2006; Stocksbridge (SK29), JF, May 2004.

Nomada fulvicornis Fab., Blaxton Common 2 (SE60), MEA, June 2005, May 2006; Cali Heath (SE74), MEA, April 2006.

Nomada robertjeotiana Panzer, Strensall Common (SE66), MEA, July 2004, July 2006.

Melecta albifrons (Forster), Dovecliffe (SE30), JDC, April 2006, May 2006; Flamborough Head (TA26), MEA, May 2006.

The recent new species, *Anthidium manicatum* and *Nomada flava* seem to have become well established and will not be considered in future reports, nor will *Sphecodes crassus*.

Records of the solitary species have been retained electronically on the software DBASEIV. The records have now been transferred to Microsoft EXCEL in response to the need to use more modern software. Except for a small reference collection, my aculeate Hymenoptera specimens are being dispersed to various museums, the Yorkshire specimens going to the Royal Scottish Museum, Edinburgh (Granton Centre), Liverpool Museum and the Collections Resource Centre, Leicestershire.

Reference

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Erratum

The editor apologises for the unfortunate misspelling of Professor Trevor Kerry's surname (as Kelly) in both the rubric and text (lines 7 & 21) in the review of his "Of Roseates and Rectories" (*Naturalist* **132**: 60, 2007).

NOTES ON SOME DIPTERA OF A NORTH LINCOLNSHIRE SALT-MARSH

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During 2005 and 2006, Diptera at the northern end of the extensive salt-marshes which form part of the RSPB Tetney Reserve on the south bank of the Humber mouth (TA/33.04) were investigated. Seven visits were made between 2 June and 6 September, covering the main flight period for Dolichopodidae, the family of particular interest to the author.

Twenty-four species of dolichopodids were recorded, of which 10 are more or less restricted to coastal localities, seven of them being almost exclusively salt-marsh species. Of these, *Hydrophorus oceanus* (Macq.) was, as expected, the most widespread and abundant species across the marshes; in the outer marsh, which is subject to twice daily flooding, it was sometimes the only dolichopodid to be found. The habit of 'mate guarding' in this species has been described in detail by Dyte (1988): males habitually 'ride' on the much larger females, often after copulating, and remain in this position for long periods, presumably thereby ensuring that no other male has an opportunity to mate with the same female. These flies often occur in huge numbers on soft mud and skate on the still surfaces of tidal gutters, often whilst paired up, and the females also make short flights, still carrying the attendant males.

Small numbers of *Muscidideicus praetextatus* (Hal.) were also found on the outer marsh. This Nationally Notable dolichopodid is here at its most northerly recorded site on the east coast of Britain; it must be only a matter of time before it is recorded on the north bank of the Humber.

Other typical coastal/salt-marsh species were *Dolichopus diadema* Hal., *D. notatus* Staeg. (Nationally Notable, and not yet recorded in Yorkshire), *D. sabinus* Hal., *D. strigipes* Verr. (Nationally Notable), *Poecilobothrus principalis* (Lw.), *Machaerium maritimae* Hal., *Campsicnemus armatus* (Zett.) and *Syntormon pseudospicatum* Strobl.

Rhaphium consobrinum Zett., also present here, is a typical member of the salt-marsh suite of dolichopodids, larvae having been reared from saline mud (Dyte 1959), but it is not exclusively coastal and in Yorkshire it has been recorded inland on river banks. *Medetera petrophiloides* Parent, although widely distributed in a variety of habitats, is often found in coastal dunes; this and *M. saxatilis* Coll. were recorded at Tetney.

Non-dolichopodid flies mainly, or exclusively, associated with coastal/salt-marsh localities recorded at Tetney included the widespread cranefly *Dicranomyia sera* (Walker), the RDB horsefly *Haematopota bigoti* Gobert, the soldierfly *Nemotelus uliginosus* (L.), the stiletto-fly *Acrosathe annulata* (Fab.), the robber-fly *Philonicus albiceps* (Mg.), and three danceflies, *Hilara lundbecki* Frey, *Rhamphomyia maculipennis* Zett. and *R. simplex* Zett.. Finally, the coastal hoverfly *Sphaerophoria rueppellii* (Wied.) was present, and two common picture-winged gall-flies *Campiglossa absinthii* (Fab.), which at coastal sites is associated with Sea Wormwood and *C. plantaginis* (Hal.) which attacks Sea Aster.

ACKNOWLEDGEMENTS

I am obliged to Ian Higginson, Humber Warden, RSPB, for permission to undertake this small study; a full species list has been deposited with the RSPB. My thanks are also extended to my colleague C.E. (Peter) Dyte for copies of his published works referred to herein.

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Printed in Great Britain by Titus Wilson & Son, Kendal ISSN 0028-0771

October-December 2007

Number 1063
Volume 132

The Naturalist

A QUARTERLY JOURNAL OF NATURAL HISTORY FOR THE NORTH OF ENGLAND

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The Nature Diaries of Fred Holder (1891-1963) – *John Edmondson*

Florence Eva Crackles 1918-2007

Yorkshire Naturalists' Union Excursions in 2006 – *Albert Henderson and Adrian Norris*

Published by the Yorkshire Naturalists' Union

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The Naturalist and *Bulletin* are issued free to individual members of the Yorkshire Naturalists' Union and to Affiliated Societies.

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THE PEREGRINE FALCON IN THE SOUTHERN DISTRICT OF THE YORKSHIRE DALES NATIONAL PARK

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Introduction

Historically, the Peregrine Falcon, *Falco peregrinus peregrinus*, as a regular breeding species in the Yorkshire Dales was confined to the Dentdale and Howgill Fells area, with sporadic attempts in the Swaledale fells (Nelson, 1907; Ratcliffe, 1980; Mather 1986). In the late 1970s, the species began to expand away from this area into the Craven Dales, one site being occupied in 1977, with first breeding taking place there and at two other sites in 1978 (C.G.Varty, *pers.comm.*.). This paper details the results of over 3300 hours of behavioural observations carried out from 1985 to 1998, and reports on the breeding performance and productivity of the population within the study area from 1981 to 1998.

Study area and methods

All observations detailed in this paper were carried out in the district within the National Park boundary east of the Yorkshire/Cumbria boundary and south of the Wensleydale/ Swaledale watershed; an area of c.1230 km^2. Breeding records from Swaledale are omitted from this paper, as are data for pairs breeding within the Upper Nidderdale AONB to the east of the National Park boundary.

Observations using X10 binoculars and X30 telescope were made from discrete distances ranging from 100m to 600m throughout the year, although less frequently during the period August to February. Each year an attempt was made to find all pairs within the study area. Intensive work began from the end of February at known breeding sites. Once occupation was confirmed, time was then spent searching other likely sites or following up reported or rumoured pairs. Any site confirmed occupied by paired birds was counted as a breeding opportunity, and this figure was used as the baseline figure from which breeding performance and productivity was calculated. After the first week of April all sites were re-visited to confirm if incubation had begun, this being determined from observation of the behaviour of the adult birds. In order to reduce disturbance, nest ledges were not examined unnecessarily to determine clutch size. At some crags, observation points allowed a view down onto the nest ledge; however, these were the exceptions and the majority of sites were only observable from below. All sites at which incubating birds were confirmed were then visited at least once a week until either breeding failure became apparent or the young fledged. From 1985 to 1987 behavioural observations were made at one site from the start of incubation until the young fledged, being undertaken daily from first light until dusk. Terminology used to describe behaviour follows Cramp and Simmons (1980), Ratcliffe (1980) and Cade (1982). Analysis of breeding performance and productivity follows Ratcliffe (1980) and Newton and Mearns (1988). Prey items were identified during prey deliveries or from pluckings.

Results and Discussion

Timing of breeding and breeding behaviour

Unlike birds occupying high altitude sites in areas such as the Scottish Highlands, which vacate the crags during the winter (Lack, 1986), breeding sites in the study area tended to be occupied throughout the year. Established pairs often remained together and were usually found quietly perching on the crags, sometimes quite close together in a tree or on the same ledge. From 1986 to 1996, 42 visits were made to eight sites during the period 1 August to 28 February. Occupied sites were found on 31 visits (74%), 23 (55%) including both male and female.

Although on one occasion a pair was noted posturing on a previously used nest ledge in October, ledge displays and other interactions between the sexes became more frequent from

late January and early February. 45.2 hours of observations were made at this time of year; males spent 19.1% of the time prominently perched either on prospective nest ledges or high on the crags, and both males and females were observed at the cliffs for 31.8% of the time. Prospecting behaviour by males became more frequent during late February and both sexes began to visit ledges, usually with the males taking the lead to be followed later by the females. Courtship activity seen included aerial display flights by males, and high soaring flights by both sexes jointly. Ledge displays included nest scraping by both sexes, head low bows and bill touching. Bill touching has also been reported to take place in flight (Cramp & Simmons, 1980), but this was not observed.

Pairing activity intensified during March and from the middle of the month birds started copulating, although not as frequently as later during egg-laying; the earliest dates that copulation was witnessed being 10 and 16 March. Males also started to bring prey for the females; although the amounts were symbolic at first, the females were still hunting for themselves at this time. As the time for laying approached, females spent long periods perched on the nest ledges or sitting in the nest scrapes. Copulation began to take place more frequently, sometimes in rapid succession, one pair making four attempts in a 2.5 hour period and another three attempts in 1 hour.

Whilst egg-laying, females were totally dependent on the males for food, doing no hunting for themselves. They fed either by receiving prey directly from the males, or by retrieving prey previously cached by males. In 1986, continuous observations were made at one site during the egg-laying period from 28 March until 7 April. The female was seen to feed on 11 occasions, six items (54.5%) being received directly from the male, with all food transfers taking place on the nest ledge. The remaining five items (45.5%) were retrieved by the female from food caches on the cliff. During this time the pair copulated frequently; of the 26 attempts observed, 16 (64%) took place with the female perched in a tree and the rest on various ledges on the crags; no copulations were seen to take place on the nest ledge. All copulations occurred between 08.40 and 18.35 hr, the majority of attempts (84.6%) after mid-day, with a peak between 16.00 and 17.00 hr (23%). This is in contrast to Cramp and Simmons (1980), who state that copulations are probably most frequent in the first hour of daylight or around mid-day.

The laying of the first egg in the scrape is the most date-specific point of the whole breeding cycle, although very little precise data were obtained, the only definite first egg date was on 7 April (D.Urwin, *pers.comm.*). Estimated first egg dates, calculated back from known hatching or fledging dates range from 27 March to 18 April, although these are probably subject to an error of +/- two or three days. During egg-laying, females remained close to, if not actually on the nest ledge, progressively spending more time in the scrape covering the clutch, until finally the eggs were covered for the whole time (Table 1). Only two observations were made of male falcons covering the incomplete clutch, both involving

TABLE 1.
Amount of time one pair spent covering the eggs during laying.

Date	Total observation time Hrs	mins	% of time spent covering clutch
29/03/86	8	35	5.2
30/03/86	11	35	11.9
31/03/86	9	53	3.2
01/04/86	7	42	8.9
02/04/86	11	36	19.4
03/04/86	11	30	29.1
04/04/86	11	30	36.2
05/04/86	11	9	45.6
06/04/86	11	12	81.4
07/04/86	11	40	100.0

the same male, once for 20 min. and again for 40 min. Generally, males avoided the nest ledges at this time except when delivering prey to the females.

Once clutches were complete, males regularly began to visit the nest ledges, seeking to take a share of the incubation duties. They also stopped taking prey to the ledges during incubation, any food transfers which did take place occurred elsewhere on the crag or in the air. 886.9 hours of observations were made of birds incubating; males were recorded incubating for 39.9% of the time, females for 59.9%. This is higher than the figure given by Ratcliffe (1980), who, based on the number of times he flushed male falcons when visiting eyries, considered that they only incubated for 12% of the time. However, the figure is within the range of 30% to 50% of the incubation share which Ratcliffe quotes from work carried out on Langara Island in the Pacific North West by Nelson (1970). Eggs were left uncovered for a total of 85 minutes (0.2%). When not incubating, males spent 20.4% of the time either loafing on, or making soaring flights over the crags, frequently harassing Eurasian Jackdaws *Corvus monedula* and Carrion Crows *C. corone* which ventured close to the nest ledges. For the remaining 39.5% of the time they were either perched out of view or absent. In contrast, when not incubating, females spent more time than the males loafing on the crags (21.9%), and less time (18.0%) absent. From 1985 to 1987, observations were made at one site continually throughout the incubation period. Change-overs took place regularly and followed a rough pattern. Whilst either sex was observed incubating at any hour of the day, there were times when one sex or the other was more likely to be doing so. It was believed that the female incubated throughout the night, although the first changeover could be very early in the morning, often whilst it was still dark, as observations were made of the male incubating at first light. The male was more likely to be incubating between 06.00 and 09.00 hr, the female from 09.00 to 13.00 hr, the male again between 13.00 and 16.00 hr and finally the female from 16.00 hr onwards.

Incubating birds were seen apparently 'dozing', but none were seen actually sleeping. A number of birds were seen fiddling with and raking pebbles and debris towards them, one bird having built up a substantial rim of debris around the front edge of the scrape. Newton (1979) refers to this as a frequent activity apparently done to relieve boredom, although the built-up edge of the scrape serves to retain the eggs if the falcon leaves in a hurry. Five small pebbles, each c. 3mm in diam., were found in a dissected pellet, although whether these came from the crop contents of the prey or were ingested deliberately is not known. Cade (1982), states that all species of falcon kept for captive breeding at Cornell University had been seen to swallow stones, incubating birds being especially prone to this behaviour; he also refers to observations suggesting that it occurs in the wild in both Peregrine Falcons and New Zealand Falcons *Falco novaeseelandiae*. This behaviour was specifically looked for whilst watching incubating falcons but was not witnessed; similarly, Treleaven (1998) states that although he is sure this occurs in the wild, he has been unable to confirm it.

Very few observations were made of females feeding during the incubation period. During the three years that one pair was watched continuously at this time, only 19 observations were made of the female with prey; she fed from 13 items, two received from the male, one she had caught herself and brought back to the crag, and nine she retrieved from food caches on the crag. She cached four more prey deliveries received from the male and another she had evidently killed herself. In contrast, during the same period a total of 52 observations were made of the male with prey; he passed seven (13.5%) of these items to the female, 19 (36.5%) were cached and he fed from 25 (48.1%), caching the remains of four of these after feeding. Rather than being provisioned by the male, it seemed that this particular female was mostly hunting for herself and feeding away from the crag. This is in contrast to Ratcliffe (1980), who states that the male does most of the hunting for the pair during incubation.

The length of incubation varies between 28 and 33 days (Ratcliffe, 1980; Cramp & Simmons, 1980). Two pairs for which the incubation period was confirmed both hatched after 33 days. The earliest hatching date recorded was 7 May 1985. Another clutch in the same year hatched a few days earlier but the exact date is not known. After hatching the young were closely brooded, although the amount of time spent brooding during the daylight

hours gradually decreased (Table 2). Brooding was mostly undertaken by females. During continuous observations at one site from hatching to fledging the four young were brooded for a total of 88.1 hours during the first 13 days. The male was observed brooding for only 2.75 hours of this time (3.2%). In all, 12 observations of the brooding male were made, the average duration being 13.9 min. (range 5-48 min.). Whilst the female continued brooding until the young were 13 days old, the male was not seen to brood after day 8, although two years previously this same male had been recorded brooding young (again a brood of four) at 13 days old; at another site a male was observed brooding a single chick up to the age of 16 days.

TABLE 2.
Amount of time one pair spent brooding young during daylight hours

Age of young (days)	Total observation time Hrs	mins	% of observation time spent brooding young
1	13	14	87.5
2	10	39	82.2
3	12	50	89.9
4	9	38	80.9
5	9	30	76.3
6	9	15	74.4
7	12	50	77.7
8	11	17	61.0
10	10	57	41.0
11	13	38	41.2
12	13	50	31.2
13	10	47	28.1

During continuous observations from hatching to fledging at one site with a brood of four, young were fed at all times between first light and sunset, except between 06.00 and 07.00 hr, although feeds were given between 05.00 and 06.00 hr. Feeds were most frequent between 07.00 and 08.00 hr, again between 11.00 and 15.00 hr and increased again between 16.00 and 21.00 hr, with a peak between 17.00 and 20.00 hr. No food was given to the young after 21.00 hr, although both the adults were seen to feed after this time. Between hatching and fledging a total of 165 prey deliveries were made to the young (av. 3.7 per day, range 1-7 on different days). During the first week after hatching, deliveries were made with a regular rhythm of 5-3-5-3-5-3 and 5 deliveries on consecutive days. After day 7, the feeds per day became more irregular and less predictable, with little obvious relationship to the age of the young. The female made the majority of prey deliveries (83.6%) and gave the majority of feeds (73.3%). The average duration of 96 timed feeds given by the female was 14.1 min. The male did not feed the young until they were six days old and was only observed to give 12 feeds (7.3%), nine timed feeds averaging 12.9 min. After feeding, prey remains were taken from the nest ledge and cached. The young were first seen to feed themselves at 29 days old. Of 19 subsequent deliveries by the male, 15 (78.9%) of the items were left for the young to deal with themselves. In comparison, the female made 37 deliveries after this time, leaving 17 (45.9%) of the items for the young to deal with themselves. The female continued to give at least one actual feed per day until the young fledged. No feeds were seen given to fledged young, prey being simply passed to them to deal with themselves. The first co-operative hunt by the male and female was seen 10 days after hatching, although the female did not begin to hunt regularly until the young were 13 days old; prior to this, the male had been solely responsible for food provision. Of 47 prey deliveries fed to the young by the female up to day 13, 14 (29.8%) were received directly from the male, the remaining items being retrieved by her from food caches made by the male. Food transfers between male and female took place either on the crag or in the air. Aerial transfers were either talon to talon or

bill to talon. Harris (1979) reports seeing a male commonly holding prey in his talons for the female to take in her bill. Aerial transfers in this manner were not seen, neither were aerial bill to bill transfers, although these have been reported by others (Ratcliffe, 1980; Cade, 1982).

Pooling the data for all years of the study gives a total of 320 prey deliveries to broods of young. Females gave 236 feeds (73.7%), males gave 36 feeds (11.25%), and both males and females dropped 24 items each to the young for them to deal with themselves. In total 162 feeds were timed, given to broods ranging in size from one young to five, the average duration being 13.1 min. (range 1-35 min.).

Fledging dates and the age at which young fledged varied greatly due partly to different rates of development between males and females in the same brood. In one brood, two males fledged at 42 days old, and the remaining male and single female at 45 days old. It is also possible that single young may be at a disadvantage, developing and fledging later than those in multiple broods, although this is a personal impression based on limited data which needs investigating more thoroughly. Frank (1994) came to a similar conclusion, believing a single youngster to be at a disadvantage because it does not have siblings with whom to practice flying and hunting. Similarly it has been noted that young Red Kites *Milvus milvus* which come from broods of one also appear to mix less readily (D.Simpson, *pers.comm*). Fledging dates varied from 11 June to 10 July. Two broods which fledged between 11 to 19 July and 14 to 28 July respectively were both possibly from second clutches (i.e. re-lays after loss of the first clutch). Once fledged the young gradually spent less time at the breeding crags, venturing further afield but still returning to roost. How long the young remain at the breeding site was not determined exactly and may vary between broods and between individuals in the same brood. In 1998 three of the five young fledged at Malham were still at the Cove on 26 July. A stay of five days at another site between 29 August and 2 September 1987 found only the adults present. The latest date a juvenile was still frequenting a breeding crag was 1 August.

A total of 83 records of intruding Peregrine Falcons at nest sites were made during the course of the study, 20 (24%) being immatures and the rest being adults. Intruding birds were recorded at sites in all months except July, October, November and December. There were more records during April and May, with 45 and 24 records respectively (54% and 29% of all records). This corresponds with Treleaven (1998) who also found an increase in the number of intruding falcons during April and May at Cornish sites.

Breeding performance and productivity

During the study, 33 sites were identified as being occupied by paired birds either regularly or irregularly; the majority (25) lie at an elevation between 214m to 427m, with one at 150m, six between 428m to 534m and one at 540m. Four sites were located in disused quarries and six in working quarries, albeit on inactive faces; the remaining 23 sites were all natural crags. Average nearest neighbour distance between eight regularly occupied territories in the south of the study area was 8.25 km (range 5.0-14.25 km). However, in 1996 and 1998 two pairs nested on crags only 1.75 km apart.

Pooling the data for 1981 to 1998, a total of 163 pairs was confirmed holding territory in spring, including one pair which laid a second clutch after losing the first, giving a total number of breeding opportunities of 164 (Table 3). Of 134 clutches known to have been laid (81.7% of breeding opportunities), four were laid in disused Raven *Corvus corax* nests, two in disused nests of Carrion Crow, and the rest on bare rock ledges. Average clutch size from 32 clutches of known size at the start of incubation was 3.84 eggs (Table 4). A total of 246 young fledged from 97 successful broods (59.1% of all breeding opportunities or 72.4% of clutches laid). Productivity averaged 1.5 young per breeding opportunity, the average fledged brood size varying between 1.4 and 3.75 young per successful brood in different years. Two broods of five young fledged successfully, both at the same site. The sex ratio of 55 young from 19 broods sexed at fledging was 30 males to 25 females. Breeding performance and productivity was greater in disused quarries (92% and 2.3 young per breeding opportunity).

TABLE 3.
Breeding performance and productivity. 1981-1998.

Year	No of territories confirmed occupied by paired birds in the spring	No of occupied territories suspected	No of clutches confirmed laid	% of confirmed pairs	No of pairs which fledged young	% of confirmed pairs (Breeding Perfor-mance)	% of clutches laid	Total no of young fledged	Average fledged brood size	Average no of young per confirmed pair (Product-ivity)
1981	5	0	4	80.0	3	60.0	75.0	8	2.67	1.60
1982	7	0	5	71.4	3	42.9	60.0	9	3.00	1.29
1983	5	1	4	80.0	3	60.0	75.0	8	2.70	1.60
1984	8	0	7	87.5	5	62.5	71.4	17	3.40	2.12
1985	7	0	7	100.0	5	71.4	71.4	10	2.00	1.43
1986	9	0	6	66.7	2	22.2	33.3	4	2.00	0.44
1987	7	4	7	100.0	5	71.4	71.4	14	2.80	2.00
1988	8	3	8	100.0	4	50.0	50.0	9	2.25	1.10
1989	7	4	7	100.0	4	57.1	57.1	15	3.75	2.14
1990	11	1	6	54.5	4	36.4	66.7	11	2.75	1.00
1991	12	0	10	83.3	8	66.7	80.0	21	2.62	1.75
1992	12	2	9	75.0	6	50.0	66.7	15	2.50	1.25
1993	12	4	10*	76.9	8	61.5	80.0	11	1.40	0.80
1994	13	0	12	92.3	10	76.9	83.3	29	2.90	2.20
1995	12	2	10	83.3	8	66.7	80.0	19	2.40	1.60
1996	9	5	9	100.0	8	88.9	88.9	19	2.40	2.10
1997	10	4	8	80.0	7	70.0	87.5	13	1.90	1.30
1998	9	4	5	55.5	4	44.4	80.0	14	3.50	1.50
Total	**163**	**34**	**134**	**81.7**	**97**	**59.1**	**72.4**	**246**	**2.54**	**1.50**

*Includes two clutches at one site when a second was laid after the first one disappeared.

TABLE 4.
Average clutch size compared to fledged brood size.

Clutch Size	No of clutches	Fledged brood size	No of broods
1	0	1	18
2	1	2	28
3	8	3	34
4	19	4	15
5	4	5	2

Despite having the larger number of breeding opportunities (n = 67), sites on managed grouse moors had the lowest breeding performance and productivity (35.8% and 0.75 young per breeding opportunity). Although pairs which did breed were as successful as at other sites in the area with an average fledged brood size of 2.08 young per successful pair (Table 5), this suggests that environmental factors on grouse moors were not limiting overall success.

Non-laying and the failure to hatch were the two main confirmed causes of breeding failure (Table 6), although non-laying is very difficult to confirm with absolute certainty and the figure given represents an absolute minimum. In total, 19 failures (28% of all failures or 11.6% of all breeding opportunities) were considered to be due to human interference. Although this suspicion was only confirmed in five cases, there is strong circumstantial evidence that it happened at others. At one site which had previously recorded 67% breeding success with a sympathetic keeper, the success rate fell to 9% after a change of gamekeeper.

TABLE 5.
Breeding performance related to eyrie location and land use. 1981-1998.

Location/Land Use	No of sites	No of breeding opportunities	No of successful attempts	Breeding performance (%)	No of young fledged	Productivity (No of young per breeding opportunity)
Grassland pasture	14	54	36	66.7	110	2.04
Working Quarry	6	18	14	77.8	28	1.5
Disused Quarry	4	25	23	92.0	58	2.3
Grouse Moor	9	67	24	35.8	50	0.75

TABLE 6.
Causes of breeding failure 1981 to 1998.

Cause of breeding failure	No of failures	% of number of failures	% of breeding opportunities (n=164)
Non laying – suspected (adult pair)	3	4.4	1.83
Non laying – confirmed (adult pair)	4	6.0	2.44
Non laying – adult male paired with immature female	7	10.4	4.27
Non laying – site occupied by an immature pair	1	1.5	0.61
Site taken over by Raven pair – Peregrines remained at site but didn't lay	1	1.5	0.61
Eggs laid in Carrion Crow nest which collapsed or was destroyed	1	1.5	0.61
Clutch deserted by female after male disappeared	2	3.0	1.22
Clutch deserted prior to hatching	1	1.5	0.61
Clutch failed to hatch after full term incubation	10	15.0	6.20
Female seen to eat one egg, remaining egg in clutch failed to hatch	1	1.5	0.61
Eggs disappeared soon after laying – robbery suspected	5	7.5	3.05
Eggs robbed – confirmed	2	3.0	1.22
Eggs disappeared at hatching – robbery suspected	3	4.4	1.83
Young disappeared – robbery suspected	1	1.5	0.61
Young robbed – confirmed	1	1.5	0.61
Young died – natural causes	1	1.5	0.61
Young died – poisoned	1	1.5	0.61
Adult female disappeared – human interference suspected	1	1.5	0.61
Adult female shot on nest ledge whilst incubating	1	1.5	0.61
Cause of breeding failure unknown –human interference suspected	3	4.4	1.83
Cause of, or stage at which failure occurred, unknown	17	25.4	10.37
Total number of breeding failures	**67**		**40.9**

With 59.1% of pairs breeding successfully and 1.5 young per breeding opportunity, productivity in the Dales compared favourably with that of recovering populations in other areas. Newton and Mearns (1988) give the breeding success and productivity of 397 breeding attempts in south-west Scotland between 1974-1982 as 47% of pairs breeding successfully, with a productivity of 1.1 young per territorial pair. Ratcliffe (1980) and Newton (1988) both

suggested a productivity figure of 1.0 to 1.5 young per territory holding pair as being the range required in a self-sustaining population; the Dales figure falls within this range. Newton and Mearns (1988) also reported a number of adult male and immature female pairings (5% of the breeding pairs) in their south-west Scotland study. In the Dales, 10 such pairings were recorded (6% of the territory holding pairs); at least one of these females laid eggs although she later deserted them, and another may have done so as an adult male and immature female pair were located at one site late in the season with two well grown young. There were no records of adult females being paired with immature males.

Although a number of pairs regularly bred on popular climbing crags, voluntary restrictions negotiated by the YNU Protection of Birds Committee with the British Mountaineering Council, and a generally positive attitude from the climbing community meant that no breeding failures could be attributed to disturbance from climbers; nevertheless, the amount of disturbance on one traditional crag mentioned by Nelson (1907) may have discouraged pairs from settling during the spring. Birds were regularly reported during the winter months, but apart from one year when the site was occupied by an adult male and an immature female, this site remained vacant throughout the study.

Prey selection, hunting success rate and food caching

A total of 70 prey items was identified at nest sites (Table 7). Feral Pigeon *Columba livia* was the most frequently recorded species (74%) and Red Grouse *Lagopus lagopus* recorded only once at a nest site although pluckings were found close to another. However, this is probably an artificial bias as most observations were made at sites away from, although within, foraging range of Grouse moors. As much of the prey brought back to the nest sites, especially by the males, was already plucked, usually headless and unidentifiable, some of these may have included Red Grouse. Waders, despite their abundance, figured very little with only a Woodcock *Scolopax rusticola* specifically identified at one site. Elsewhere a

TABLE 7.
Prey items identified at nest sites.

Prey species	No of items
Feral Pigeon *Columba livia*	52
Starling *Sturnus vulgaris*	3
Unidentified passerine: Pipit – Finch size	3
Unidentified passerine: Starling – Thrush size	3
Jackdaw *Corvus monedula*	2
Blackbird *Turdus merula* or Ring Ouzel *T. torquatus*	1
Meadow Pipit *Anthus pratensis*	1
Song Thrush *Turdus philomelos*	1
Woodcock *Scolopax rusticola*	1
Swift *Apus apus*	1
Red Grouse *Lagopus lagopus* (chick)	1
Rabbit *Oryctolagus cuniculus*	1
Total	**70**

Dunlin *Calidris alpina* skull found close to one site and Golden Plover *Pluvialis apricaria* pluckings near another may have come from Peregrine Falcon kills. Feral Pigeon were also the most frequent species seen captured, 15 (68%) of the 22 kills witnessed. Two Eurasian Jackdaws were seen killed, both by the same female falcon in the same year. Other species noted with single records of each were Meadow Pipit *Anthus pratensis*, Common Starling *Sturnus vulgaris*, an unidentified finch and a distant unidentified pigeon species, either Feral Pigeon or Stock Dove *Columba oenas*.

Of the 22 kills witnessed, all but one were birds caught and held in the air, a similar figure to that quoted by Treleaven (1998) who states that 95% of kills he witnessed were birds

caught and held in the air, rather than being knocked out of the sky and then retrieved from the ground; the one exception being a Red Grouse chick which was pursued and caught on foot. All observed kills took place within 1.5km of a breeding cliff, and all except the grouse chick mentioned above were begun from a perch on the cliff rather than from a high soaring flight. Four of the kills were made by males and 18 by females. However, these represent only a small proportion of the total number of observations of falcons with prey (n = 570). The majority of kills were made at much greater distances from and out of view of the breeding cliffs.

A total of 159 flights at potential prey species was recorded. If all these are considered as hunting attempts, the 22 kills give a success rate of 13.8%. This is low, but higher than the figure of 7.5% quoted by Ratcliffe (1980) from the work of G. Rudebeck and similar to the figure of 16% given by Parker (1979). Assessing hunting success is complicated by the fact that Peregrines will frequently chase prey which, especially when not hungry, they have no real intention of trying to catch. Treleaven (1998) identifies this as Low Intensity hunting, in contrast to a more determined, hunger driven attempt at capture (High Intensity hunting). Using Treleaven's criteria for determining one from the other, of the 159 flights witnessed, 71 were identified as being genuine attempts to secure a kill (i.e. High Intensity hunts). Using this figure, the 22 kills give a success rate of 30.9%. When hunting Feral Pigeons the success rate was similar, with 15 kills from 46 flights (32%). If the figures for females working alone are considered, the success rate of 12 kills from 42 attempts (28.6%) was again comparable. The success rate of three kills from 13 attempts (23.1%) for males working alone was slightly less. These figures compare favourably with Treleaven (1977, 1998) who observed that a kill can be expected every four or five flights. Hunting success improved if both falcons worked together. From 55 attempts by single falcons only 15 kills were made (27.3%). When hunting together, the success rate increased to 43.75% (seven kills from 16 flights); females made the majority of the kills (six of the seven observed). This is in contrast to Treleaven (1977) who states that in his experience, when working together, it is usually the male which makes the kill.

Of 570 observations of falcons with prey made during the course of the study, 142 (25%) were items retrieved from food caches. There are a number of references to Peregrine Falcons using food caches, for example Ratcliffe (1980), Treleaven (1977, 1998) and Parker (1979). Cade (1982) regards food caching as being probably universal among all members of the genus *Falco*. Observations confirmed that it is a commonplace activity among Peregrines, especially during the breeding season, and possibly also during the winter months, although only one observation of a Peregrine using a food cache at this time was made. No observations were made of food being cached after the young fledged. The adults were invariably mobbed by the young as soon as they appeared with prey and had no opportunity to cache it. Cade (1982) states that females with young evidently watch males cache prey as they are able to retrieve it later. However, this statement may not reveal the whole truth. Observations in the Dales were made on well established pairs which had been breeding together for a number of years, and brooding females were frequently watched flying straight to and retrieving prey from caches that would have been out of view from their position on the nest ledges. Similarly males were seen to retrieve and feed from prey cached by females. In such cases it is perhaps possible that the birds were learning the caching sites favoured by their mates and checked these first when looking for food.

Observations of birds using food caches were made on 370 occasions; 142 items (38.4%) were retrieved from the caches and 228 items (61.6%) were cached. Of these 228 items, 103 (45.2%) were fresh items cached before they were eaten; 44 (42.7%) by males and 59 (57.3%) by females; the remaining 125 items (33.8%) were items cached after being partially eaten; 14 (11.2%) by males and 111 (88.8%) by females. The duration between caching and retrieval was timed for 14 prey items, the average time being 7 hr 20 min. (range 10 min.-22 hr 8 min.). Caching was not a random activity, prey not being simply 'dumped' to be picked up later. Certain ledges were favoured above others and the food items were deliberately placed in carefully selected locations. If the bird was not satisfied with its concealment, prey

would be repositioned or even taken to a new location on the same or a different ledge. Only once was a bird seen to just drop prey onto a ledge. Caches were usually located on ledges on the main breeding crag. However, on one occasion prey was cached on a small outcrop away from the main cliff, giving an opportunity to examine the location, a small crevice (75mm wide x 150mm deep x 150mm high) hidden behind a stone.

ACKNOWLEDGEMENTS

A number of organisations and individuals have contributed to this study, and without their help and influence much of the work carried out would not have been possible. Firstly and foremost I would like to thank Doug Simpson who gave me the opportunity to work for the YNU Protection of Birds Committee and study the Peregrine Falcon in the Dales, and over the years the many discussions with him in the field whilst surveying for breeding Peregrine Falcons have provided me with a better understanding of the behaviour of the species. The late Clive Varty provided much advice and information on the historical distribution of the Peregrine Falcons in both the Dales and other parts of the county and also provided data on the breeding success of the species in the study area for the years 1981 to 1984. The late David Urwin provided comparative information and breeding information for pairs in Wensleydale and the northern parts of the study area. I am grateful to a number of landowners and farmers who allowed access to their lands, especially the late John Sayer who also provided generous support. Peter Wright and Colin Straker provided important assistance and information on Peregrine Falcons, and more recently, Mark Owen and Frances Winder continued the National Park Authority support. Doug Simpson, Mike Denton, Albert Henderson and John Mather provided useful comments in the preparation of this paper.

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THE NATURE DIARIES OF FRED HOLDER (1891-1963)

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INTRODUCTION

Fred Holder (1891-1963) of Southport kept a detailed record of his natural history observations over a period of almost 51 years. Through his association with other local naturalists, he gathered intelligence on interesting and unusual occurrences, but he did not neglect the commoner or more mundane plants and animals. Indeed, one of his far-sighted projects was to prepare a phenological herbarium containing samples of the first records of flowering of plants in his neighbourhood. Such unpublished observations are now of value in assessing the impact of global warming.

Between 1912 and 1961 he also compiled a general herbarium, often in association with his friend J. Norman Frankland of Austwick and Horton-in-Craven whom he first met by chance in 1926 (Shorrock, 1998). Both men's herbarium collections were eventually donated to the World Museum Liverpool (**LIV**), and many of these have been databased. Both were keen diarists, though Norman (whom Fred dubbed "the poet") was more discursive and Fred (whom Norman dubbed "the scribe") more factual.

In the late 1970s, staff of the then Merseyside County Museums (now National Museums Liverpool) undertook the arduous and lengthy task of preparing a card index to the subjects mentioned in the diaries. With over 6,100 entries, some containing references to more than 50 separate pages, completion of this thankless task has happily facilitated the preparation of a computerised version of the index. This is kept on the file server of National Museums Liverpool and together with the diaries it can be consulted, by appointment, by visitors to the Botany archives.

Fred W. Holder photographed on Ainsdale shore, 23 March, 1932

SUMMARY OF CONTENTS

The diaries are kept as a series of hard-cover notebooks, some of which are commercial diaries, others simply being marked up with headings. The earliest diary dates from 1912, and the last is from the year of his death, 1963. The final entry, dated Wednesday 14 August 1963 begins "W[eather] mod. & cool with sunny periods." and concludes "The LBB [lesser black-backed gull] passes over low before noon". He died on the same day.

The numbering of the notebooks is somewhat complex: although there were 71 notebooks numbered in sequence, plus several without a number towards the end of the sequence, the

'volume' numbers refer to groups of notebooks rather than to individual books. Thus there are 18 numbered volumes, 17 of which contain the dairies and volume 18 a series of obituaries and miscellaneous notes. There are many other notebooks, some containing tabbed indexes to localities or to plant species, others listing the "Birds of the Ribble Estuary" (compiled in 1913); these are identified by code letters. Book H contains a list of the plants in Holder's herbarium. The diaries include many tipped-in monochrome photographs. There is also a short-lived diary by his wife dating from 1926; a pencilled annotation confirms that its contents largely match those of her husband's diary for the period, but in lesser detail.

The main topics covered by the diaries are listed in Table 1, along with the number of entries for each topic and, in the case of plants and birds, the approximate number of separate species mentioned. Note that each database entry covers only one volume of the diaries (in a very few cases two entries are needed when the number of page references exceeds the 255 characters available in the database field), so the actual number of topics is smaller. 'Pursuits' is a category referring to trapping and shooting where no target species is mentioned.

TABLE 1.
Summary of diary contents.

Topic	No. of database entries
Plants	2078 (c. 680 species)
Birds	1750 (c. 240 species)
Places	1224
People	627
Publications	237
Invertebrates	124
Mammals	65
Amphibians	23
Pursuits	20
Reptiles	7
Fish	6

GEOGRAPHICAL COVERAGE

The majority of the observations are from the Southport area, though excursions or longer visits further afield are also reported; for example, there is a lengthy account from a holiday in Llandudno, and he also records visits to Ravenglass and Walney island in Cumbria. Sufficient detail is given in most instances for a record to be localised to within a 10 km grid square, more occasionally to a 1 km square. Some references to places are not field reports; for example, he mentions visiting the Liverpool Museum and the Walker Art Gallery. One of his friends, the naturalist Reg Wagstaffe, was Keeper of Zoology at the Museum; together they wrote a paper on recent plant records from the Southport area (Holder & Wagstaffe, 1928). This was a precursor to the second edition of the *Flora of Liverpool* (Green, 1933).

BIOGRAPHICAL CONTENT

In some ways, the 'people' coverage of the diaries is the most interesting, since it records and illustrates the activities of a wide circle of naturalists only a few of whom feature in Desmond (1994). Many of these are referred to only by cryptic abbreviations or nicknames, and considerable research would be needed to identify these individuals. However, the entries are now readily accessible and can be a useful source of information in the future. In several instances their addresses and/or occupations are given or inferred: for example, Mr Tomlinson, gamekeeper of Meols Hall; Richard Caunce, of Rookery Cottage, Fish lane,

Burscough, "the elder, keeper to Sir T.F. Hesketh, Rufford"; and Liverpool Museum Keepers W.H. Stansfield (Botany) and Reg Wagstaffe (Zoology), as well as W.M. Tattersall of Manchester Museum. Occasionally mentioned are Messrs Hine, Taxidermists (W.R. Hine of Lord Street, Southport); Gertie (or Elnora) Langdon is frequently mentioned, as are T.A. Coward of Bowden, Cheshire, Norman Frankland, John "Ossie" Griffiths, S.J. Hunt of Marshside and the author H.E. Witherby. There are several references to individual obituaries in the *North-western Naturalist*, the *Southport Advertiser* and other publications.

Species coverage

Although the major coverage focuses on wildlife in general and plants in particular, the bird data are perhaps of greater scientific value since they report rare occurrences of migrants and vagrants as well as more routine observations of the resident avifauna. Botanical data naturally include observations of the rarities of the Sefton coast, one of the richest areas for botanical diversity in Lancashire (now Merseyside); they embrace planted species and garden escapes as well as natives. In general there are eight or fewer references to a particular plant in each volume, making the total number of records somewhat smaller than is the case for birds, where the records are dominated by repeated references to various species of gull, duck and wader. The database contains the scientific names of both plants and animals, reducing the user's reliance on vernacular names for locating species. Invertebrate coverage is sparse, though among the lower vertebrates there are several references to Natterjack Toads. Mammal records are rather few and casual, and there are none for Badgers and only three for Moles.

Literature references

These references form an intriguing, if minor, element of the diaries' contents. It would seem that they served not only as nature diaries, but also as "commonplace books" in which miscellaneous facts, news items and cuttings were recorded. Holder was evidently a regular reader of the local papers, *The Southport Visitor* and *The Guardian*, and he also makes frequent reference to books such as Morris (1895). He occasionally quotes from the journals *The North-western Naturalist* and *Bird Notes and News* published by the Royal Society for the Protection of Birds. There are also references to the Southport Society of Natural Sciences, whose earliest published report dates from 1890. Holder's own articles include an early paper on "rare plants in the Southport area" (Holder, 1920), as well as more recent papers in the *North-western Naturalist* (Holder, 1953, 1954).

Conclusion

Unpublished, undigested information of the kind we find in these voluminous diaries is less readily accessible than the carefully edited, selectively cited information in published sources. Dr Theodore Green, author of *Flora of Liverpool*, in a letter to Reg Wagstaffe dated 12 December 1931, wrote "I congratulate Mr Holder and yourself upon your comprehensive observation" (Green, 1931). Both F.W. Holder and A.G. Holder are acknowledged as Recorders in *Travis's Flora* (Savidge *et al.*, 1963), but Fred Holder's herbarium of some 2,500 sheets is not mentioned there as a source of vouchers for his records. However, a contemporary record can often have more value as an original observation, precisely because it is seen in context. For that reason, his diaries will surely remain as a lasting testament of his devotion to field natural history.

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BOOK REVIEWS

Methods in Stream Ecology, edited by **F.R. Hauer** and **G.A. Lamberti**. Pp.877, with numerous figs. & tables. 2nd edition. Academic Press. 2006. £52.00 hardback.

This extensively updated and revised second edition, which comprehensively covers all aspects of stream ecology, is divided into six sections: covering (A) Physical Processes, (B) Material Transport, Uptake and Storage, (C) Stream Biota, (D) Community Interactions, (E) Ecosystem Processes and (F) Ecosystem Ecology. Included in each section are detailed descriptions of the processes involved, as well as useful information on field and laboratory techniques associated with that topic. Section C also provides good identification keys to the organisms. One of the few criticisms of this book is that it concentrates on the North American situation and nowhere is this more apparent than in these identification keys; although methodologies may be applicable elsewhere, many of the organisms treated are only common there. Sections on communities and ecosystem processes are comprehensive, covering primary and secondary production, nutrient enrichment and riparian processes, and could easily form the basis of any school or university ecology course. There is a very topical final section covering the use of organisms for assessing environmental quality and an overview of cause-effect relationships between environmental stresses and the biota.

The book is well written and very well illustrated with many colour pictures and photographs, particularly of some groups of organisms. The comprehensive reference lists at the end of each chapter lead to the second criticism of the book, again pertaining to its North American bias. Most, if not all, of the contributors are from North America, as are most of the references. It would have been helpful to have at least some wider global coverage of expertise and material. That said, it is an excellent book of great use and interest to anybody working in the field of stream ecology.

EGB

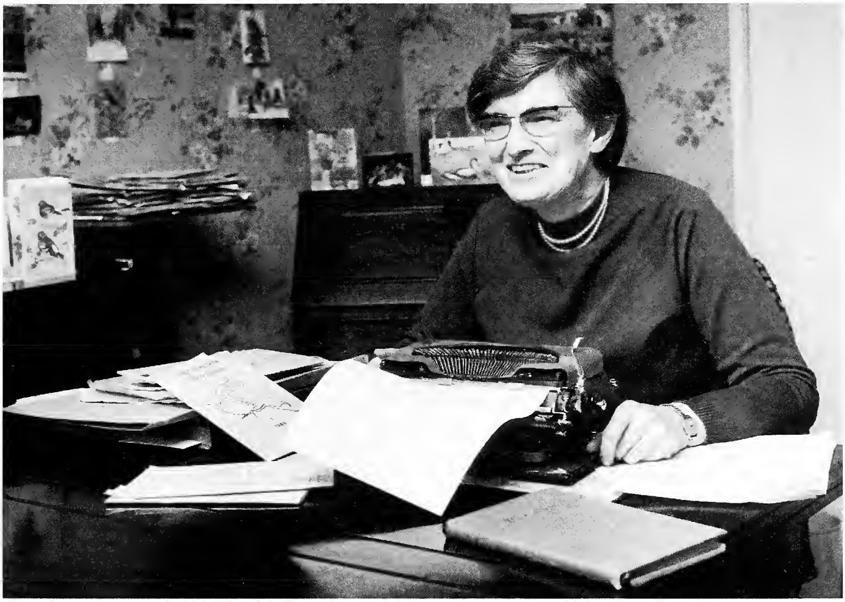
Dictionary of Environment and Conservation by **Chris Park**. Pp.522. Oxford University Press. 2007. £19.99 hardback.

Described as a major new Oxford subject dictionary covering all things 'green', this volume, from a publishing house renowned for its excellent dictionaries, will prove a valuable addition to the reference works on naturalists' bookshelves. As naturalists are increasingly involved with environmental matters that impinge on their specialisms, access to 8500 entries on a broad spectrum of resource material, as well as definitions, on conservation and environmental science will be greatly appreciated. Ten appendices include national hazard assessment scales, a geological time-scale and useful websites.

MRDS

FLORENCE EVA CRACKLES
1918-2007

Despite an upbringing at a difficult time in her native Kingston upon Hull, Eva managed to achieve a Bachelor of Science (General) Degree (External, London) in mathematics and chemistry at the age of 22. Her mathematics tutor was Dr Jacob 'Bruno' Bronowski, a great man who clearly influenced Eva's intellectual and philosophical development. However, it was Eva's father who sowed the first seed of a flourishing career in the study of natural history, as he took Eva for walks in the countryside.



Eva Crackles c.1970 (source: *Hull Daily Mail & Times*).

Eva's first venture into the scientific study of natural history began when she joined the Hull Scientific and Field Naturalists' Club in 1941 and the Yorkshire Naturalists' Union in 1943, both on the recommendation of Tom Stainforth, who took her on many excursions until his untimely death in 1944. At that time Eva divided her interest between birds and botany. In the field of ornithology she was very active, both at Hornsea Mere and on the Spurn Peninsula. She was friendly at that time with Henry Bunce, George Ainsworth, and Ralph and Lilian Chislett, well-known YNU ornithologists. However, in the early 1950s Eva's interest in birds waned as greater interest in plants took hold. The wartime bombing of Hull had produced oases of wildflowers on derelict sites and Eva's early accounts of these, her contributions of '*Crackles Country'* for the John Humber Column of the *Hull Daily Mail*, and her work on the evening class lecture circuit for the Workers' Educational Association gained her the respect of both the general public and academia. Bob Lewis introduced Eva to the Botanical Society of the British Isles, and she soon took the reins as recorder for vice-county 61 (S.E.Yorkshire) both for the BSBI and for the YNU.

Eva was elected a Fellow of the Linnean Society of London in 1966 and her research on *Calamagrostis stricta*, *C. canescens* and their hybrids found at Leven Canal led to a Masters Degree from the University of Hull in 1978. In the 1980s, following the Wildlife

and Countryside Act, Eva was engaged in characterising the botanical importance of potential Sites of Special Scientific Interest. In 1990, after an enormous amount of research involving many local botanists, Eva published *The Flora of the East Riding of Yorkshire*. It was shortly after this that Eva's mobility declined and she became wheelchair-bound in the field. I got to know Eva at this time and soon became her chauffeur and, with Don Grant, Eric Thompson and Frank Kenington, her honorary wheelchair-pusher on some botanical excursions. I soon learned to ignore Eva complaining "I wish you would find smoother terrain, I'm trying to make notes", for the learning experience gained by accompanying her in the field. Eva appeared at public enquiries to protect threatened sites in vice-county 61 and she was a formidable foe of Local Authority officers.

In 1991, the University of Hull conferred the Degree of Doctor of Science *honoris causa* on Eva for her services to education, botany and nature conservation, and she was further honoured in 1992 when the Queen bestowed upon her an MBE for her services to botany and conservation. In 1998, when the BSBI launched the Atlas 2000 project, Eva realised with failing health that she could no longer cope with such a massive undertaking, and retired as BSBI and YNU recorder, as well as from the Linnean Society. She was elected Honorary Life member of the BSBI in 2000, by which time she had become incapable of caring for herself.

Eva served as a Divisional Secretary, President, Vice-President, Flowering Plants Recorder and Referee of the YNU, and was a prolific contributor of interesting papers and articles in *The Naturalist* and *Bulletin of the Yorkshire Naturalists' Union*. The range of botanical subject matter covered in Eva's published works (of which only those mainly published in YNU publications are listed below) is broad. Eva was also a supporter of the Yorkshire Wildlife Trust, the South Holderness Countryside Society and the East Yorkshire Local History Society.

Eva's training in mathematics and chemistry made her very intense and scientifically exacting in all that she did, and she had a formidable memory for detail. She also possessed a dry sense of humour and warmth, particularly when engaged in the subject of her fascinating family history, cricket or "The Archers". If there were no wild flowers in heaven, there are now.

Peter J. Cook

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YORKSHIRE NATURALISTS' UNION EXCURSIONS IN 2006

Compiled by
ALBERT HENDERSON and ADRIAN NORRIS

LEYBURN OLD GLEBE FIELD AND WEST WOOD (VC65) 20 May 2006

INTRODUCTION (D. Millward)

On a day when the forecast was for persistent heavy showers, only seven members, from six societies, turned up in a fine drizzle; however, heavy showers failed to materialize and by lunchtime the drizzle had cleared. All, except the President, were botanists, so the meeting amounted to a botanical outing, albeit quite a rewarding one. The Old Glebe Field was spectacular and members spent well over an hour enjoying the rich diverse sward before transferring to the Bolton Estate where Lord Bolton had kindly permitted access to West Wood. Here the lunchtime break was enlivened by a close view of a yearling roebuck; a second was seen later in the day.

Both sites yielded St George's Mushrooms to the delight of one member; a couple of lichen specimens were collected, a showy black bug *Ceropis vulnerata* was spotted and also a wolf spider; otherwise a very blinkered group concentrated on the botany. However, everyone crawled (literally) under the roots of a large beech tree on the river bank to inspect fresh otter spraint, competently found and identified by Sarah Jupp, and competently photographed by a new member of the Yoredale NHS on his first meeting. Inevitably far more accessible spraint, in full daylight, was found further downstream. Members then scrambled without mishap up a steep bank back to the path (not a risk-assessment thought in mind) with just the stench of dead rabbits, probably taken from the many drop box traps set about the wood.

BOTANY (D. Millward)

The Excursion visited two sites, the YWT Nature Reserve, Leyburn Old Glebe, a meadow on calcareous till, and West Wood on the Bolton estate, so a variety of habitats yielded quite a lengthy species list. Timing is everything: the reserve was at its most interesting with several hundred *Anacamptis morio* in flower and a number of *Neotinia ustulata*. *A. morio* occurred in three colour forms with the green veining showing up more clearly on the pale pink and white form than on the vastly more abundant deep purple form. The Bradford Botany Group followed us in the afternoon and thought there might also have been an *Orchis mascula* x *morio* hybrid, but this needs confirming. *O. mascula*, which had been fairly abundant earlier in the month, was much eaten by rabbits. The Old Glebe Field would still be a lovely site without any orchids. [Since writing this report, it would appear that tempting fate in this way was perhaps not a bright idea, since between our visit and the following Saturday a selfish individual removed half the *N. ustulata*.] *Primula veris*, *Polygala vulgaris*, *Viola hirta* and *V. riviniana*, all in profusion, made a colourful display with the added interest of *Ophioglossum vulgatum*, the newly opening *Briza media*, and *Helictotrichon pratense*.

West Wood was replanted more than 100 years ago; beneath the veteran beech, now beginning to shed limbs, an unusual ground flora of *Succisa pratensis* and *Luzula pilosa* had developed. Around the probably even older veteran oak, the ground flora was dominated by *Luzula sylvatica* and some *Teucrium scorodonia*. The ride was lined with *Geranium sylvaticum*, just coming into flower, but *Primula vulgaris* was over. Members tried to speculate what woodland type had occurred here in the past, given the current diverse ground flora, but gave up and just enjoyed a large patch of *Paris quadrifolia* near the river.

At the extreme west end of the wood, a hillock of glacial material supported another rich calcicole flora including *Carlina vulgaris* and was crowned with a good colony of

Aquilegia vulgaris. Sadly the hillock had been recently planted with sycamore, an unfortunate choice. Surrounding the hillock, wet wood supported amongst other species *Carex acutiformis*, *Eupatorium cannabinum* and probably *Dryopteris carthusiana*, but it was too early to tell.

REIGHTON GAP / PRIMROSE VALLEY (VC61) 17 June 2006

INTRODUCTION (S. Priest)

Glorious sunshine tempted a splendidly large group of 26 members to visit Primrose Valley Holiday Village, by kind permission of the General Manager, Mr David Eccles. The group split up to explore the undercliff and cliff-top habitats north and south of the village with the aim of collecting data to contribute to Buglife's Soft Coast Survey. Later 14 members, representing 16 affiliated societies, assembled for refreshments at the Royal Oak, where the President, Helen Jackson, took the chair.

It was evident from the reports that the botanists had had a particularly profitable day, while the coleopterists had been somewhat disappointed. A copy of the report of the last excursion to Hunmanby on 12 June 1971 was provided by Janetta Lambert; it was particularly pleasing to note that *Parnassia palustris* still existed there. It was observed that the soft cliffs here are protected by the headlands of Filey Brigg to the north and Flamborough Head to the south, resulting in a slower rate of erosion than elsewhere on the coast and this, coupled with the calcareous character of the boulder clay, results in a more mature and diverse community.

CONCHOLOGY (A. Norris)

The very hot dry weather made it very difficult to find some of the more common species that might have been expected on the cliffs, but a careful search of selected damp locations produced a number of interesting records. The very local *Leiostyla anglica* occurred in at least one of the flushes on the cliffs just south of Primrose Valley and *Vertigo antivertigo*, also very local in VC61, was found on the marshy shores of the freshwater lake and also on the cliffs to the south of Primrose Valley. This lake produced a number of interesting records and deserves a more detailed study when the vegetation is not so lush and the water not so difficult to access.

LEPIDOPTERA (J. Newbould)

In many places bare open clay left numerous opportunities for invertebrates, with a number of mining bees seen, but not identified, and *Cicindela campestris*. During the day a total of seven adult butterflies were recorded including *Aricia agesti* by M. M. Hartley and A. Norris near the car park, the migrant *Colias croceus* and three *Vanessa cardui*. Fox *et al*. in *The State of Butterflies in Britain and Ireland* (2006) report on the colonisation of south and east Yorkshire by Brown Argos in the period 2000-2004 by southern colonies, which are more gregarious in their choice of food plant. Most of the party saw *Ochlodes sylvanus*, whilst P. Tannet recorded the larvae of *Inachis io* on nettle at Butchers Haven.

Numerous moths were recorded during the day, with P. Tannet recording *Odezia atrata*, M. Denton recording *Phlogophora meticulosa* and J. Newbould recording *Euclidia glyphica* (a coastal moth in Yorkshire) and *Nymphula stagnata*.

COLEOPTERA (M.L. Denton)

In an attempt to generate records for the area, the two coleopterists present spent most of the day inspecting three recently dug ponds at Low Fields. These ponds, which were dug three years ago as receptors for Great Crested Newts, were very disappointing as they held not a single water beetle, the only visible life in them being a few Corixid (water boatman) larvae. Although not a contributory factor against the presence of water beetles, non-native plants had been introduced, rather than allowing vegetation to occur naturally. It was also interesting to note the lack of insect life in the mud at the pond edges, where, especially given the very warm weather conditions, a number of ground beetles belonging to the

genus *Bembidion*, along with a number of bugs, would normally be present. The reasons for this general lack of insect life are unknown, but investigations into the water quality would perhaps throw some light on the problem.

Sweeping the vegetation around these ponds, although it yielded a myriad of spiders and bugs, produced very few beetles. The only species of note was *Dascillus cervinus*, a locally distributed species whose larvae feed at the roots of various plants, including orchids.

ODONATA (S. Priest)
Cliff-top pools to the south of the Holiday Village were explored in the company of local naturalists John Harwood and Sid Cochrane. Although designed for the translocation of Great Crested Newts, the principal interest on this occasion seemed to be Odonata. Seven species were recorded: *Enallagma cyathigerum*, *Coenagrion puella*, *Ischnura elegans*, *Libellula depressa*, *L.quadrimaculata* and *Anax imperator*. Of particular note were a number of *Sympetrum fonscolombii*, a migratory species of which there had been a recent influx along the south and east coasts. As we admired this dazzling selection, one of the Broad-bodied Chasers was caught and eaten by a female Emperor!

MARINE FLORA AND FAUNA (A. Norris)
The sandy shores of the southern half of Filey Bay were examined within the 1 km square SE/1278. The shore was notable for the small number of species found on the day; a similar survey after a storm in early spring would have produced more than twice the number of species. Living examples of *Dosinia lupinus*, *Chamelea striatula*, *Donax vittatus*, *Tellina tenuis*, *Ensis siliqua* and *Mactra corallina* were easily found. The commonest find on the shore was the dried remains of the Masked Crab *Corystes cassivelaunus*. An interesting observation was the number of legs, washed up on the shore, of the Common Edible Crab which had obviously been cooked.

PLANT COMMUNITIES (J. Newbould)
During the day, we surveyed a number of different plant communities along the coast from Murston Sands (TA/1279) to Butcher Haven (TA/1277). Plant communities ranged from the NVC W8 Ash-Field Maple-Dog's Mercury Community of Primrose Valley to W24 Bramble-Yorkshire Fog scrub and maritime cliff communities of Red-Fescue-Carrot (NVC type MC11) to the Red Fescue-Yorkshire Fog (MC9) maritime cliff community. Within these broad plant communities, there were numerous patches of small communities and habitats, principally cliff flushes featuring *Equisetum palustre* and *Dactylorhiza praetermissa*.

BOTANY (R. Middleton)
The coastal cliff slopes are among the last remaining fragments of natural habitat left in this intensely cultivated vice-county. Unfortunately for much of their length, the rate of erosion is such that only plants which can quickly colonise bare ground survive. However, in the sheltered environment of Filey Bay, the soft Boulder Clay cliffs are relatively stable and a rich community of plants has become established on this base-rich substrate.

At Primrose Valley, a small stream cuts through these cliffs providing a shaded, wooded environment with luxuriant growth of ferns, including *Phyllitis scolopendrium, Athyrium filix-femina, Dryopteris filix-mas* and *D. dilatata*. The sea cliffs to the north side of the ravine provided a spectacular display of *Geranium sanguineum*, a very scarce plant in south-east Yorkshire but known at this locality since 1877. Closer examination of the dry slopes in the vicinity revealed large quantities of *Serratula tinctoria*, accompanied by *Trifolium medium, Ononis repens, Leontodon hispidus* and *Carlina vulgaris*, and the rarer *Filipendula vulgaris*. Flowering orchid species were well represented, with frequent *Dactylorhiza fuchsia* and *Anacamptis pyramidalis*, occasional *Ophrys apifera*, and single specimens of *Listera ovata* and *Gymnadenia conopsea* being observed. In the wetter flushes, *Equisetum palustre*, *Pulicaria dysenterica*, *Ajuga reptans*, *Sanguisorba officinalis*,

Stachys officinalis and a single, but thriving, group of *Parnassia palustris* were located. To the south of the valley, the wet areas were of a slightly different character, usually well colonized by *Eupatorium cannabinum* and, less frequently, by *Triglochin palustre* and *Valeriana dioica*. Sedges, however, were poorly represented and only *Carex flacca* and *C. otrubae* were seen on the sea cliffs.

A notable site was the elongate pond to the north of Butcher Haven, where the clean, deep water of this long established pond was covered with the floating leaves of *Potamogeton natans* and notable marginal plants included *Carex rostrata* and rare clumps of *Carex hirta*, *Lychnis flos-cuculi* and *Oenanthe fistulosa*. *Rosa pimpinellifolia* was also found nearby.

Immediately below the holiday camp car park, the natural flora of the cliffs was enriched by a host of well-established garden escapes including *Crocosmia* x *crocosmiiflora*, *Centranthus ruber*, *Saxifraga* x *urbium* and a spectacular clump of a white-flowered form of *Polemonium caeruleum*. Over 160 species were recorded along a 2km stretch of coast, mostly within 100m of the sea.

BRYOLOGY (J.M. Blackburn)

Recording began in the Primrose Valley woods. Hawthorn on the slopes was unproductive, but the banksides had *Eurhynchium striatum, Fissidens taxifolius, Plagiomnium undulatum* and *Rhynchostegium confertum*. At the top of the slopes down to the stream, ash trees were rewarding, with *Rhynchostegiella tenella*, *Ulota phyllantha, Zygodon viridissimus* and *Frullania dilatata* present. The stream banks had *Pellia epiphylla* and rocks there had a large patch of *Conocephalum conicum*.

Although the cliff slopes were dominated by coarse grass, *Calliergonella cuspidata, Dicranum scoparium, Scleropodium purum* and a large patch of *Rhytidiadelphus triquetrus* were found in the grassy areas, and the damper areas had abundant *Aneura pinguis*, with *Cratoneuron filicinum* and *Dicranella varia*.

After lunch, a visit was made to Speeton Cliffs at the southern end of the recording area; these were largely covered with impenetrable bushes, but the bare and grassy places had species similar to those recorded earlier. A modest total of 22 species was recorded.

HAYBURN WYKE (VC62) 1 July 2006

INTRODUCTION (J.M. Blackburn)

It was a fine sunny day when 25 members representing 19 Affiliated Societies assembled in the paddock at the Hayburn Wyke Hotel. Members generally dispersed into the woodland area during the morning where a network of footpaths enabled access to all parts of the woods. Most people examined the shoreline at some point during the day, where the waterfall provided a pleasant focus and the ornithologists could enjoy some sea-watching. Several members walked along the old railway and found it quite productive. Mammals were sparse, but rabbits and deer slots were seen, and an adder was spotted on stones on the beach.

Although the hotel was unavailable for the meeting, fortunately the weather enabled us to enjoy an *al fresco* meeting in the grounds, chaired by the President Helen Jackson and attended by 14 members. Following the reports, thanks were expressed to the National Trust and the hotel proprietors for use of the paddock.

CONCHOLOGY (A. Norris & D. Lindley)

The Conchological Section was represented by five of its members. In order to make the best use of such a good turnout, we decided to concentrate most of our effort on visiting the three 1 km squares surrounding the base of the Nature Reserve from which no recent records had been made. The lower part of the Nature Reserve (TA/0097) has been well worked in the past, with 47 species having been recorded from this area. This policy resulted in a total of 55 new records, 24 for TA/0096; 20 for TA/0196, and 11 for TA/0197, the latter being a sliver of coastal cliff just above the beach. All the areas examined were

within the Nature Reserve, so it was a pleasant surprise to find that we had added a further two species to the reserve list: *Merdigera obscura* and *Candidula intersecta* both of which were found close to the base of the cliffs within TA/0197. It was also interesting to note that *Leiostyla anglica* and *Spermodea lamellata* both proved to be widespread within the reserve. Subsequently, Tony Wardhaugh spent a little time in TA/0097 and added *Lymnaea balthica* (= *L. peregra*) to the reserve list. This brings the total for the Nature Reserve to 50 species.

COLEOPTERA (F.E. Kenington and M.L. Denton)
The locality provided an interesting mix of habitats with pasture, hedges, woodland, cliffs, and a stream with waterfall into a basal pool on a stone-packed beach.

Within the woodland, nine examples of *Pyropterus nigroruber* on a pine stump or nearby bracken were located by the conchologists. This saproxylic species has the national status of Notable A, having two main centres of population – around south Yorkshire/ Derbyshire/Nottinghamshire and north Yorkshire.

A single example of the weevil *Anthonomus piri* was beaten from vegetation within the woodland by Mike Denton. All previous records of this species, which is associated with apple, have been no further north than Norfolk. The record is therefore an addition to the Yorkshire List. The large longhorn *Rhagium mordax* was also located in the woodland.

The snail predator *Cychrus caraboides* was rather aptly found by the conchologists on the sloping cliff face. Both Bill Dolling and Mike Denton located the RDB3 Psephenid *Eubria palustris* near seepages along the cliff bottom. This is the seventh Yorkshire locality for the species, the records of which indicate a very wide distribution.

Rotting seaweed along the shore line produced a number of rove beetle species which favour this habitat, including *Cafius xantholoma, Aleochara obscurella* and *Thinobaena vestita,* all of which have a wide distribution along the Yorkshire coast.

DIPTERA (R. Crossley)
Recording was confined to the coast and to a small number of Diptera families. Fifteen species of Empidoidea (dance-flies and long-headed flies) were recorded by the stream at the top of the waterfall; the list included two metallic-green species, *Liancalus virens*, Britain's largest dolichopodid, typical of such localities, and the beautiful *Poecilobothrus nobilitatus*, which has conspicuous white-tipped smoky wings.

Several rather dry seepages along the base of the cliffs yielded additional species, but the main interest here were the Crane-flies. Of the 12 species recorded, three are Nationally Notable and one, the tiny and fragile *Orimargo virgo*, is RDB3. This rarity, which was found in some numbers, was recorded further up the coast at Beast Cliff in 1996; it was new to me, as was *Dactylolabis transversa* (Nb), of which a single specimen was found. Hitherto, Yorkshire records for this species have been restricted to the dales and foothills of the Pennines. A number of Soldier flies were recorded, including *Ocxycera nigricornis, O, morrissi* and *O. pygmaea*, and the Nationally Notable Snipe-fly, *Ptiolina obscura*.

In spite of the drought and the heat, this was a profitable visit with useful recording, which included numerous additions to the site list.

OTHER INSECTS (B. Dolling)
The only member of the Mecoptera recorded was a single male specimen of *Panorpa germanica*. Two species of Ornithoptera were also noted, *Tetrix undulata* and *Pholidoptera griseoaptera*, both on cliffs near the beach, and 11 species of Hemiptera, all of which were common and widely distributed.

MARINE FLORA AND FAUNA (A. Norris & D. Lindley)
The fact that low tide occurred early in the afternoon meant that we were able to examine the marine molluscan fauna. A total of 12 species were located, all but one being gastropods. The only bivalve noted was a single specimen of the common mussel *Mytilus*

edulis. The most interesting find was a very young specimen of *Aplysa punctata*; normally, adults of this fascinating sea-slug can only be found in the very early part of the year when they come inshore to breed in rock pools. The rock pools on this part of the coast, although few in number, produced several other interesting finds, including large numbers of *Cancer pagurus* and *Carcinus maenas*. The Beadlet Anemone *Actinea equina* was also common in places. The shore, although interesting, was on the whole rather poor, but this may be partly due to difficulty in accessing parts of the shore on this boulder-strewn section of the coast.

BOTANY (J. Lambert)
This well known site made a delightful day's botanising. Starting from the paddock near the hotel, an old lane had *Fumaria capreolata* and fine specimens of *Tamus communis* climbing up the trees. Soon after entering the National Trust woodland, Mike Yates found *Polystichum setiferum*, undisturbed woodland near the coast being a typical habitat for it. Other species noted were *Oxalis acetosella, Milium effusum, Lysimachia nemorum* and *Veronica montana. Luzula sylvatica* was abundant in many places and ferns included *Athyrium felix-femina, Blechnum spicant* and *Phyllitis scolopendrium*. Down a steep bank, Richard Middleton found *Chrysosplenium oppositifolium* by the stream. Few genuinely maritime species were noticed, but as the shore was reached one clump of *Plantago maritima* was seen. Crossing the footbridge over the stream brought us to a fine view of flowering *Vicia sylvatica* amongst *Equisetum telmateia*. Leaves only of *Polygonum bistorta* were amongst brambles under trees and in an open grassy area. Other species preferring this habitat were *Centaurium erythraea, Pulicaria dysenterica* and *Pilosella officinarum*. Margaret Hartley and Helen Jackson saw over 50 spikes of *Dactylorhiza fuchsii* in the 'orchid field'. More dense woodland produced *Melica unifora, Sanicula europaea, Carex pendula* and *Mycelis muralis*. Some members visited the old railway track where *Equisetum sylvaticum* and *Galium odoratum* were seen, and also one of the best plants of the day, *Epipactis helleborine*, which was found by Marjorie Curtis.

BRYOLOGY (J. M. Blackburn)
Mosses were well represented on the woodland floor with *Atrichum undulatum, Cirriphyllum piliferum, Dicranum scoparium, Eurhynchium striatum*, two common *Fissidens* species and *Mnium hornum*. The attractive *Hookeria lucens* was seen in several places and *Isothecium myosuroides, I. alopecuroides, Orthodontium lineare* and *Plagiothecium undulatum* were also present. Epiphytes were less evident, but *Metzgeria furcata, M. fruticulosa* and *Frullania dilatata* were seen and an elder supported the highlights of the day with *Orthotrichum affine, O. pulchellum, Ulota bruchii* and *U. phyllantha*.

The area around the stream produced *Didymodon spadiceus*, tree-common *Brachythecium* species, *Cratoneuron filicinum, Dichodontium pellucidum, Conocephalum conicum* and *Lunularia cruciata*. The important record for Hayburn Wyke is the presence of *Tortula freibergii* by the waterfall and on the acidic rocks up the stream. This rare moss has a disjunct distribution in Britain, being first found in Sussex and subsequently by the Blackwater Canal in Manchester. It was found at Hayburn Wyke in 1992 by Fred Rumsey, since when it has been seen in a further 9 tetrads in VC62, making this area a stronghold for the plant in Britain. A walk along the old railway line later in the afternoon did not add to the list. A total of 59 species was seen on the day.

MYCOLOGY (J. Webb)
Despite the dryness of the previous weeks, a wet area had survived sufficiently to maintain a small trickle along a gully to the shore. Foraying from the source down the gully to the shore produced eight myxomycetes, of which *Arcyria minuta* is of interest as it is uncommon and new to VC62. Six ascomycetes and several hyphomycetes were collected; of the latter, two were on myxomycetes. It was no surprise to find *Blistrum tormentosum*

on the *Metatrichia floriformis*, whereas *Trichiocladium opacum*, which was found on *Arcyria incarnata*, does not appear, either in Ellis and Ellis (*Microfungi on Land Plants*) or Rogerson (*Myxomyceticolous Fungi*) as a coloniser of any myxomycete. *Trichocladium opacum* has been recorded on the bark and wood of several deciduous trees, including *Fagus* and *Quercus*, both of which occurred close to the rotting log from which *A. incarnata* was collected. It seems reasonable to assume that the hyphomycete had strayed on to the myxomycete.

Joyce and Ken Payne reported the following: three species of rust fungi found in the upper part of the woodland, *Puccinia arenariae* on *Silene dioica* (plentiful), *P. luzulae on Luzula sylvatica* (several groups affected) and *P. veronicae* on a scattering of old leaves of *Veronica montana*, and *P. punctiformis* on a single plant of *Cirsium arvensis* in the car park.

Two plant galls were recorded: *Eriosoma* sp. distorting half the leaf of *Ulmus* sp. and *Psyllopsis fraxinii* on *Fraxinus excelsior*. The leaf mines of *Paraphytomyza hendeliana* on *Lonicera periclymenum* and *Phytomyza primulae* on *Primula vulgaris* were also noted

ROTHERHAM (VC63) 22 July 2006

INTRODUCTION (J.R. Comley)

The excursion was based at the Magna Science Adventure Centre, at Templeborough, Rotherham. Thanks must be expressed to Helen Johnson and the staff of Magna for hosting this meeting and extending their opening time an additional half hour completely free of charge. This venue was selected for several reasons: it is quite a long time since a multi-disciplinary group surveyed the area and it has an important and ancient history of continuous human activity, mostly industrial, initially based on the locally mined iron ore and later on coal mining, but also due to the presence of the lowest fordable point on the River Don, eventually, of course, superseded by bridges. Therefore, the natural wildlife of the area had to cope with the changing environment, frequently resulting in the presence of unexpected species adapting newly developed niches, with a predictably variable degree of success, so many species populations were, and are, short-lived.

The day started fine, but at lunchtime there was a tremendous cloudburst that lasted about half an hour. The area only took about 2 hours to dry out, so the meeting was not greatly inconvenienced. For the teatime meeting, Magna allowed us to use, at no cost, the public cafe, cleared for the occasion, which is within the site of the Templeborough Roman fort. There was another cloudburst during our meeting, the rain on the acres of roof area overloading the drains, and an electrical short set off the fire alarm. We had to vacate the building and held most of the meeting in the covered entrance with a howling gale until the fire brigade gave the all clear. Though the above may not be a usual meeting résumé, it indicates that we had unpredictable nature in all its forms.

CONCHOLOGY (A. Norris)

The hot dry weather made it very difficult to locate many of the land snails and slugs, even though a downpour, which occurred in the middle of the day, brought out large numbers of the Common Garden Snail, *Cornu aspersum*. Visits were made to three 1 km squares, one in Sheffield and two in the Rotherham district. The visit to the Blackburn Meadows Nature Reserve just over the administrative border and thus part of Sheffield (SK/4191) produced 17 species, mostly freshwater. The occurrence of *Physella acuta*, an introduced species, and *Planorbarius corneus* both in large numbers, suggested that introductions into the ponds within the reserve have occurred on several occasions. Don Island was visited in the early afternoon, after the rain; 15 species were located, mostly freshwater, from the canalised section of the River Don. We did, however, locate two young examples of *Limacus flavus* under old logs, which had ventured out looking for moisture. In total, we recorded 28 species and added 40 new records to the mapping scheme.

ORNITHOLOGY (M.L. Denton)

Although not visiting the area with a view to birdwatching, as the only ornithologist present I took on the task of compiling a report. Not an easy task when one considers that I was looking for beetles and had no binoculars! The only species seen on the ponds on Blackburn Meadow N. R. were Little Grebe, Grey Heron, Mallard, Lapwing and Black-headed Gull. Blackcap and Willow Warbler were still in song and two Stock Doves, a species which some birdwatchers rarely recognise as they dismiss them as Feral Pigeons, were seen flying over the marsh.

A Kingfisher was seen flying along the river, providing evidence that the Don is not as polluted as formerly. At least one family of Grey Wagtails was also on the river; formerly restricted to streams and rivers on the hills as a breeding species, during the last few decades, it has spread to lower elevations.

ENTOMOLOGY (M.L. Denton & W.A. Ely)

One group whose status has significantly changed in South Yorkshire over the last 15 years is the dragonflies, and the sight of Emperor Dragonflies and Banded Demoiselles flying quite commonly over the River Don within a mile of the centre of Rotherham illustrated the point dramatically. Although they are not scarce, the abundance of *Sisyra fuscata* on Don Island also demonstrated that the waters of the Don Canal and River Don are clean enough to support a strong sponge fly population. Unfortunately, the downpour that occurred during the day caused overflows of polluted water from several drains and this turned a long section of the river filthy grey.

The most exciting insects on this visit were the bugs. Among the four species of shield bug, which Bill Dolling reported, was *Dolycoris baccarum*, in abundance; the only previous Yorkshire record is from Hatfield Moor in 1980. Four rhopalid bugs were found by Bill, two of them new to Yorkshire: *Rhopalus subrufus* (one adult and several immature specimens) and *Aelia acuminata* (a nymph) at Blackburn Meadow N.R., as well as *Nysius ericae* and *Orius laticollis*. Plant bugs were also well represented, with *Pseudoloxops coccinea* on Don Island and *Chlamydatus pullus, Oncotylus viridiflavus* (new to Yorkshire) and *Lygus wagneri* from Ickles being the most interesting.

The dry conditions which had prevailed for the previous fortnight did nothing to assist the coleopterists in their pursuit of beetles. Sweeping vegetation produced little with the exception of grass seeds, etc. A single example of the ground beetle *Bembidion quadripustulatum* was located on mud along the edge of Holmes Farm Flash at Blackburn Meadow N.R. by Bob Marsh. This is the first authentic Yorkshire record of this nationally Notable B species.

The seed weevil *Oxystoma cerdo*, collected by Bill Dolling at Magna, is associated with vetches, particularly Tufted Vetch, and has a mainly northern distribution in England. Since 1970, however, it has been found in south-eastern counties where it is possibly a recent colonist. Despite its northern distribution, this is the first record on the YNU database for this nationally Notable B species. Another seed weevil *Bruchela rufipes,* a recent introduction which is spreading in Yorkshire, was found on Weld at Ickles. Other finds included the antlike beetle *Anthicus formicarius* on Don Island, the weevil *Hypera rumicis* at Blackburn Meadow N.R. and Magna, the rove beetles *Platystethus nitens* and *Gnypeta rubrior* at Holmes Farm Flash, and the pollen beetle *Pria dulcamarae*.

The less common flies on Don Island included the cranefly *Nephrotoma cornicina,* the phantom midge *Chaoborus flavicans,* the non-biting midges *Polypedilum quadriguttatum* and *P. pullum, Einfeldia pagana* and *Chironomus pallidivittatus,* the scuttle fly *Phora edentata,* the greenbottle *Lucilia ampullacea* and the anthomyiid *Heterostylodes pratensis*. Opposite the island on waste ground at Ickles was the big-headed fly *Tomosvaryella nigritula* and the fruitflies *Trupanea stellata* and *Acanthiophilus helianthi,* the latter a nationally Notable insect. The ichneumons *Perithous divinator, Hoplismenus bidentatus* (the first Yorkshire record) and *Stenodontus marginellus* (the first for VC63) and the braconid *Aspilota ruficornis* were on Don Island, while the ichneumon *Zaglyptus varipes*

and the braconid *Microgaster grandis* were at Ickles.

This meeting contributed significantly to our knowledge of the entomology of the River Don corridor at the Sheffield-Rotherham boundary.

BOTANY (D.R. Grant)

In the morning, members visited the Blackburn Nature Reserve. The grassy banks on the way had *Dipsacus fullonum* and *Galega officinalis*. Brambles were represented by *Rubus sprengelii*, *R. dasyphyllus*, *R. echinatoides* and many stands of the garden bramble, *R. armeniacus*. The main pond in the reserve had the usual marginal plants, together with *Lythrum salicaria* and *Eleocharis palustris*. A roadside path had male plants of *Humulus lupulus* and a single plant of *Lepidium latifolium*. A very small pond, provided for school children to engage in dipping was almost completely covered with *Nymphoides peltata*. A visit to the Don canal, revealing large stands of *Saponaria officinalis*, was cut short by a violent thunderstorm.

After lunch, an area of waste ground was examined, where old firebricks and steelworks slag had been tipped. It was interesting to see the distribution of species in the different areas; those associated with slag rich toxic metals such as chromium, vanadium and arsenic supported no plants, those with acid slag had *Sedum acre* and *Vulpia bromoides*, and those with basic slag supported such lime-loving plants as *Erigeron acris*, *Blackstonia perfoliata* and *Catapodium rigidum*. There were many bushes of *Buddleja davidii* throughout the whole area. Recently disturbed ground had *Atriplex prostrata* and *Sisymbrium altissimum*. The final area visited was a strip of land between the river Don and the Sheffield canal known as 'Don Island'. Two large trees of *Ficus carica* on the north bank of the canal and *Butomus umbellatus*, a rather uncommon plant for the area, on the banks of the River Don close to Rotherham were recorded.

MYCOLOGY (J. Webb)

Fifteen species were reported for the meeting, with four new records for Rotherham: *Pleospora papaveracea*, a hyphomycete on a dead *Papaver* stem; *Hymenocyphus repandus*, a discomycete on a dead *Epilobium* sp. stem; *Lachnum pygmaeus*, a discomycete on matted dead grass, and *Mollisia ventosa*, an ascomycete on a dead *Ulex* stem. One species of uncertain status in Rotherham is *Periconia bisodes*, a hyphomycete found on herbaceous litter in a reed bed. This report does not include possible results from two cultures on the bark of a *Fraxinus excelsior* tree and *Buddleja* shrub; it will take several weeks before an outcome is known.

The insect galls *Psyllopsis fraxini* on a *Fraxinus* leaf and *Diplolepis nervosa* on a *Rosa canina* leaf were also found.

PARCEVALL HALL, APPLETREEWICK (VC64) 5 August 2006

INTRODUCTION (A. Norris)

Fourteen members from 13 societies attended the meeting, even though a charge for entry into Parcevall Hall Estate was levied on us all. The weather turned out to be overcast but warm and dry, even if a bit humid. Several of the party confined themselves to Trollers Gill, whilst others took the opportunity to explore the estate as well. With no members present recording mammals, birds or insects we all agreed to pool our knowledge of these groups for this report. Due to unforeseen circumstances, the New Inn in Appletreewick was unable to accommodate us, and so the afternoon meeting was held on the grass in the grounds of the estate.

MAMMALS AND LOWER VERTEBRATES (A. Norris)

Although very few mammals or lower vertebrates were recorded, a mammal was one of the highlights of the day for a few of us. Whilst we were resting on a sunny bank, a young rabbit burst out from a hole just below us, followed by a stoat in hot pursuit. It must have been the rabbit's lucky day as we were downwind of the stoat which, on sensing our

presence, abandoned its potential kill. A second stoat also visited the car park just as the last members of our party were leaving. Tracks through the marshy areas in the gill and a high deer-fence around the estate suggested the presence of good numbers of Roe Deer. Skyreholme Beck which runs through, and under, Trollers Gill, produced reasonable sized specimens of the Bullhead *Cottus gobio*, one of which was found in a small isolated pool at the northern end of the gill.

ORNITHOLOGY (A. Norris)

Nineteen species of bird were recorded by various members of the party. The highlight of the day was probably a single Peregrine Falcon, which could be heard mewing, and was eventually seen by one of the party. Other highlights included nesting Wrens, which scalded us very noisily for such a tiny bird, Stonechat, Goldfinch and both Green and Great Spotted Woodpeckers.

CONCHOLOGY (A. Norris & D. Lindley)

A total of 37 species were recorded from four different 1 km squares along the length of Trollers Gill, and 78 records added to the recording scheme, with only one of the four squares examined (SE/0661) containing any previous records. Several species are of note, but perhaps the most interesting are two which are known to be expanding their range due, in some people's opinion, to the activities of gardeners. The first, *Boettgerilla pallens*, was first recorded from Britain in 1972 and has spread throughout the country since then and is now recorded from 48 sites in all five of Yorkshire's vice-counties. The second, *Arion flagellus*, although originally described in 1893, was not recognised widely until it started spreading; a paper published in 1987 re-established this slug as a separate species. This is the thirty-first record for this species in Yorkshire. Other species of note included *Helicigona lapicida*, which proved to be common on the southern aspect of Trollers Gill. The marsh snails, *Vertigo antivertigo* and *V. substriata* both occurred in a marsh at SE/070624 in the upper reaches of Trollers Gill. It is interesting to note that the nearest site for these two species is at Lythe Wood, Grassington, over 10 km to the west.

ENTOMOLOGY (A. Norris)

Ten species of Butterfly were recorded on the day, Large, Small and Green-veined White, Peacock, Red Admiral, Meadow Brown, Gatekeeper, Small Heath, Common Blue and Small Skipper. Amongst the moths recorded, the Silver Y was perhaps the most plentiful. Two species of Grasshopper were recorded by Andy Grayson: *Chorthippus brunneus* and *Omocestus viridulus*, both stridulating. David Lindley found a glow-worm eating a young specimen of the Brown-lipped snail *Cepaea nemoralis* and the Northern Hawker *Aeshna juncea* gave us a display on the art of flying. Perhaps the dominant insect at the end of the day was the ant. At about 3.45 pm, the temperature and humidity sparked off a mass emergence of flying ants, *Myrmica sp*., which left several of the party covered in bites.

PLANT GALLS (J. Newbould)

The party recorded just five plant galls during the meeting. However, no systematic search was made of the formal gardens, where more could possibly have been found. *Eriophyes inangulis* on the leaves of *Alnus glutinosa; Andricus fecundator* on *Quercus robur;* and *Eriophyes similis* on *Prunus domestica* were located within the formal garden. A number of members of the party noted *Janetiella thymi* on *Thymus polita* on the banks west of Skyreholme Beck, Janetta Lambert found *Jaapiella veronicae* on *Veronica chamaedrys*.

BOTANY (P.P. Abbott)

During our walk along the eastern edge of the grounds of Parcevall Hall one plant of *Mimulus guttatus* was seen in the stream. Above the woodland and across the stream the heaps of rubble on the old lead mine appeared rather barren but eventually, *Minuartia verna,* known to the lead miners as Leadwort, was found as expected, but in small quantity.

In the rocky gorge of Trollers Gill, two bushes of *Rhamnus cathartica* were growing on the cliffs and one patch of *Polypodium interjectum* was high up on the opposite side. Two plants of *Draba incana* had survived in niches on the path. In the grassland below the gorge there were numerous plants of *Plantago maritima*, previously known in VC64 from only six sites in the Dales.

LANDSCAPE (J. Newbould)

Parceval Hall is situated in the historic Manor of Appletreewick, which belonged to Bolton Priory before the monastery was dissolved in 1539. Persevell's Farm was subsequently acquired by Peter Yorke in 1589 and was little changed until the property was acquired in 1927 by Sir William Milner, who considerably altered the farmhouse and the surrounding area, by blasting out large quantities of stone. This was used to construct the present terraced gardens which were planted in the period 1930-1950. The property has a southerly aspect with gardens protected by mixed coniferous/deciduous woodland, including a number of exotic species. A number of becks pass through the property, alder-lined in places, but elsewhere an M27 *Filipendula ulmari-Angelica sylvestris* mire community was observed. Three plants of *Osmunda regalis* occur in a formal pool at the foot of the drive to the Hall.

Choice of approach to Appletreewick and Parceval Hall was along the B6160 before turning right at Barden Tower to travel northwards to Stangs Lane with the Wharfe to the west. Leaving Bolton Abbey to the south, the field boundaries had numerous veteran ash, mainly as standards. However, in a field known as Nape to the north of the Hall in a hollow-way adjacent to the Hall boundary was a 2m diameter coppiced ash stool. The tree had subsequently been pollarded and would be not less than 500 years old. This was the start of an old route via Pinder Hawes Hill to the Black Hill Road to Pateley Bridge. There were also two more standard veteran ash 300m to the north-east along this route. An old route may have been extinguished from Skyreholme to Pateley Bridge.

Viewed south from the fields above the Hall, the field systems are straight co-axils from New Road to the west and from Skyreholme Bank to the east. The fields surveyed above the Hall (Nape) were not particularly interesting, being MG9 *Holcus-lanatus-Deschampsia cespitosa* grassland. The westerly facing slopes adjacent to Tarn Gill Wood were often W25 *Pteridium aquilinium-Rubus fruticosus* community, although we did locate one area of old lead workings (SE/072612) where OV37 *Festuca ovina-Minuartia verna* was present in a typical Yorkshire Dales community with *Galium sterneri* and *Potentilla erecta*. Other members of the party located the same community to the north of Trollers Gill.

During the afternoon, a small party left the Nape area and descended the steep 100m high slope to Skyreholme Beck (alt. 180m) which arises from a spring at SE/06856165 leading immediately to an area of W7 *Alnus glutinosa-Fraxinus excelsior-Lysimachia nemorum* woodland. However, the area is a working wood pasture where grazing may have been reduced recently, as there are numerous sapling alder at the beckside, but only five trees in the marsh, which also has *Deschampsia cespitosa* and *Filipendua ulmaria*.

Unlike the plateaux, the field walls leading from Skyreholme Beck follow the curving side valleys, both to the east and west. To the west, the W25 Bracken community generally dominates the banks. To the east, the wood pasture is W8 *Fraxinus excelsior-Acer campestre-Mercurialis perennis,* although field maple is absent. Ash is generally represented by isolated pollards and the only scrub present is isolated hawthorn. Generally this wood pasture is associated with numerous crags and the scree edge. The lower grassland had numerous anthills with herbs such as *Campanula latifolia, Thymus polytrichus, Carlina vulgaris* and *Helianthemum nummularium*.

Later in the afternoon, after a walk north to Trollers Gill, climbing over dry boulders covered in moss, the party spent a good hour carefully recording the plants. The cliff faces had numerous ferns including *Cystopteris fragilis* and *Asplenium trichomanes*. Of particular interest in the scrub layer was *Rhamnus cathartica,* not commonly recorded in this area of VC64, and *Taxus baccata,* which grows from limestone fissures in the Yorkshire Dales.

BRYOLOGY (J.M. Blackburn)
The morning was spent within the grounds of the Hall. The woodland floor was quite rewarding with all the expected common species present, such as *Cirriphyllum piliferum, Eurhynchium striatum, Isothecium myosuroides* and *Thamnobryum alopecurum*. Epiphytes were not abundant, but *Dicranoweisia cirrata, Orthotrichum affine* and *O. pulchellum* were found. An elder tree produced *Ulota bruchii* and *Metzgeria furcata*. The gardens, in pristine condition, were unrewarding, but the walls around the centre had *Bryoerythrophyllum recurvirostrum, Encalypta streptocarpa* and *Homalothecium sericeum* and the car park revealed much *Marchantia polymorpha* ssp. *ruderalis*.

The afternoon was spent in the valley outside the grounds. The lower part had improved grassland where *Pleurozium schreberi, Barbilophozia floerkii, Cephalozia bicuspidata* and *Diplophyllum albicans* were seen. The stream had good patches of *Cinclidotus fontinaloides*, along with *Brachythecium plumosum, Dichodontium pellucidum* and *Rhynchostegium riparioides*. Higher up the valley, the character of the area changed dramatically with limestone hillsides. The rocks here had pads of *Tortella tortuosa, Neckera complanata, N. crispa, Rhacomitrium lanuginosum* and *Porella platyphylla*. *Reboulia hemisphaerica* was seen on a rocky slope. There was much *Fissidens dubius, Homalothecium lutescens* and *Hylocomium splendens* in the grassland. The dried-up stream bed up Trollers Gill had much *Schistidium rivulare* and *Orthotrichum cupulatum*.

This was an excellent day, with the varied habitats producing a total of 81 species.

MYCOLOGY (J. Webb)
Collecting took place in the parkland of the Hall, through the South Ploughings, adjoining Tarn Ghyll Beck, Tarn Ghyll Wood and Silver Wood, providing grassland and a mixture of deciduous and coniferous trees. Eight myxomycetes were found, the majority on rotting *Pinus*, stumps and logs. Subsequently six have been developed by bark cultures; of these, *Macbrideola macrospora* and *Didymium ovoideum* are reported to be rare in Ing's *Myxomycetes of Great Britain & Northern Ireland*, and according to *A Census Catalogue of the Myxomycetes of Great Britain & Ireland* (2000), neither had been collected previously in Yorkshire.

BOOK REVIEWS

Christian Gottfried Nees von Esenbeck edited by **Daniela Feistauer**, **Uta Monecke**, **Irmgard Müller** and **Bastian Röther**. Pp. 368, with numerous b/w illustrations & tables. Acta Historica Leopoldina (Halle), number 47, 2006. 19.95 euros, paperback, from: Wissenschaftliche Verlagsgesellschaft mbH, Birkenwaldstrasse 44, 70191 Stuttgart, Germany.

These scholarly papers are based on the Leopoldina-Meeting held in Wrocław (Breslau), Poland, 9-11 June 2005, to celebrate the famous botanist Christian Gottfried Nees von Esenbeck who was born in Odenwald in 1776 and died in Breslau in 1858. Although most of the papers are in German, the informative English abstracts, extensive literature searches and editorial apparatus will aid in their interpretation; two contributions, on 'Botany in Poland in the first half of the 19th century' and on 'Nees von Esenbeck, research botanic gardens and botany in the 21st century', are wholly in English. An analytical bibliography (41 pages) of Nees von Esenbeck's publications is also provided, together with an index of persons cited in the text (including their dates of birth and death). For those interested in the history of botany, this work not only provides detailed biographical information on this celebrated botanist but also a valuable source of information on the botany and botanists of central Europe during the first half of the 19th century.

MRDS

Essential Forensic Biology by **Alan Gunn**. Pp. x + 294, with numerous figures. John Wiley, Chichester. 2006. £24.95 paperback.

Forensic Entomology by **Dorothy E. Gennard**. Pp. xix + 224, with numerous b/w plates, line drawings & tables, plus 8 pp. of colour plates. John Wiley, Chichester. 2007. £27.50 paperback.

These two titles are indeed complementary, the latter building on the former in terms of the key role played by entomology in the interpretation of environmental evidence, as vividly portrayed in Zak Erzinclioglu's *Maggots, Murder and Men* (see *Naturalist* **127**: 38, 2002). The increasing interest in forensic science, much of it no doubt fuelled by television programmes, can be gauged from the popularity of this subject, particularly in terms of university recruitment. The many forensic science courses that have sprung up in recent years are clearly in need of suitable texts to support them. These have been lacking, so those students who still profit by books, rather than rushing to websites for disjointed material (often produced without peer review) will welcome these texts, not only to introduce them to this fascinating study, but also to provide a platform on which to build knowledge through directed reading. Attention is paid, in different ways, to the didactical approach to studying the subject, Alan Gunn commencing each chapter with an outline and objectives, and concluding with a quiz and topics for further study, as well as integrating the text with a website, and Dorothy Gennard providing useful 'boxed' hints, as well as practical work, further reading, websites and sources of equipment. Both authors are to be congratulated on paying due attention to legal acts, regulations and safety governing this work in higher education. As well as those formally pursuing this study, naturalists and biologists will find much of interest within these books, thereby shedding a new light on the application of their own specialism, not only to interpret past and present environments, but also to track down criminals.

MRDS

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Printed in Great Britain by Titus Wilson & Son, Kendal ISSN 0028-0771

January-March 2008 Number 1064
Volume 133

The Naturalist

A QUARTERLY JOURNAL OF NATURAL HISTORY FOR THE NORTH OF ENGLAND

Rare Plants in Mid-West Yorkshire: Why are they only on Limestone? – *P. P. Abbott*

The Two British *Aleuritia* Primroses: 2. Life and Death Matters – *David J. Hambler*

Forgotten Historical Records of the Small Blue Butterfly, *Cupido minimus*, in Yorkshire, and their relevance to some biological conundrums – *Geoffrey Fryer*

Revisiting the Solitary Wasps and Bees (Hymenoptera: Aculeata) of Burton Leonard Lime Quarries and Duncombe Park in Watsonian Yorkshire – *Michael E. Archer*

Published by the Yorkshire Naturalists' Union

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The Naturalist and *Bulletin* are issued free to individual members of the Yorkshire Naturalists' Union and to Affiliated Societies.

Institutions and Subscribers £32.00 (UK), £36.00 (elsewhere) Registered Charity No. 224018

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2008

Published by the Yorkshire Naturalists' Union

RARE PLANTS IN MID-WEST YORKSHIRE: WHY ARE THEY ONLY ON LIMESTONE?

P. P. ABBOTT

Presidential Address presented to the Yorkshire Naturalists' Union at Wetherby, 24 November 2007

All the nationally rare plant species which occur in Mid-West Yorkshire (VC 64) grow only in the limestone areas. Why should this be?

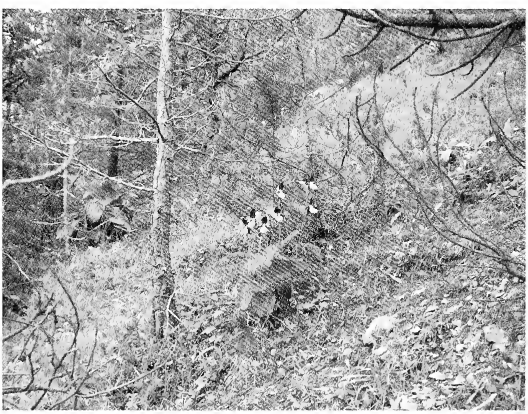
It is necessary to consider several factors which affect the establishment and growth of these plants bearing in mind that no factor works in isolation. How does the plant reproduce? Is it rhizomatous, stoloniferous or does it reproduce only by seed? How is the plant pollinated or is it apomictic? What is the method of seed dispersal? How long is the seed viable? How long does the plant live? Is it annual, biennial or perennial? What are the plant's requirements, or tolerances, with regard to soil chemistry and moisture, to temperature and shade? Is it vulnerable to predators? To answer all these questions with regard to each of the species would require a great deal of research. Here, only a brief outline is attempted.

Most of our rarities occur in exposed montane situations on steep slopes or rocky sites in the Carboniferous Limestone areas of the Yorkshire Dales. The plants here benefit from being in a high rainfall area since most of the soils are shallow, light and well-drained. Many of the soil nutrients are leached out and, in spite of some recycling of calcium by the plants themselves, the soils tend to be slightly acid. Our rare plants can obviously tolerate a nutrient-poor diet whereas many plants require richer soils where they can grow more strongly and where our less competitive rarities would be overwhelmed. They also benefit from being on steep slopes or rocky sites where the vegetation is less dense.

Each species has evolved over time to occupy its own niche in the landscape.

Lady's Slipper – *Cypripedium calceolus* L.

The Lady's Slipper orchid is widespread across Europe and into Asia, but not common. The British site of the Lady's Slipper is a steep, N-facing slope of the NVC community CG9, *Sesleria caerulea – Galium sterneri* grassland, with sparse scrub over limestone; associated species are: *Carex panicea, Helianthemum nummularium, Leontodon hispidus, Linum catharticum, Polygala amarella, Primula farinosa, Sanguisorba minor* and *Succisa*



pratensis. In Europe it grows in light shade in similar sites, often in a woodland edge situation beneath natural pine or spruce. It favours moderately moist, nitrogen-poor, base-rich to moderately acid soils (Kull 1999).

It has been shown in cultivation experiments that larger seeds have a greater germination success rate than smaller ones and that soil disturbance also aids seedling establishment (Kiviniemi 2001). The tiny orchid seeds contain little natural nutrition and, after first finding their way through the surrounding vegetation and into the soil, in order to germinate they need to form a mycorrhizal association. Although it has not yet been ascertained whether a specific fungal partner is required, it is known that the fungal hyphae penetrate the seed coat and bring carbohydrates which enable the seed to germinate and help the plant to develop in its early stages. When the first leaf has developed the orchid is then able to photosynthesize and produce its own food. The rhizome usually produces two apical buds each year and from the larger of these the following year's shoot develops and affords a limited vegetative spread (Kull 1999). It is clear that the orchid benefits from its woodland edge or scrub situation where the decaying conifer needles or leaf litter encourage fungal activity and prevent the soil from becoming compacted. The ground surface often has a mossy layer which helps to keep the soil moist.

C. calceolus is pollinated by bees of the genus *Andrena* which have a limited flight range of c.100 metres (M.Archer *pers.comm.*); therefore, although the seeds may be carried a little way by the wind, most of them are shed near to the parent plant and need to fall where there is a potential fungal partner, which means that any population increase must be a slow process and of limited extent. Although seed viability is reduced over time, scientists at Kew have achieved a limited amount of germination after 12 years of storage. However, the number of seedlings on the native site is increasing and one of them now flowers annually. Once established a plant may survive for many years since it can store food reserves in its fleshy rhizomes.

It is well known that *C. calceolus* in Britain was near extinction in the early part of the 20th century due to over-collection for private gardens and herbaria. After the one surviving plant was found, a group of local botanists and members of the Botanical Society of the British Isles, who were concerned for its safety, formed a committee to try to protect it. Since then it has been wardened throughout the flowering period. The work of the committee is now part of Natural England's Species Recovery Programme. Each year the plant is cross-pollinated using pollen from the two plants of known British origin which have survived in gardens. Seeds are collected and scientists at the Royal Botanic Gardens, Kew then produce seedlings which are kept in cultivation for a time before being planted out in suitable sites within its former range. In the early days of the programme the seedlings were planted out too soon and the mortality rate was high due to predation by molluscs and small mammals and a general lack of vigour. Now they are kept in cultivation for longer and the results seem more promising as at least seven plants have reached flowering size.

The virtue of reintroduction is a debatable point but, in the case of the *C. calceolus*, whose population was depleted by man, it seems reasonable that man should replace it.

English Sandwort – *Arenaria norvegica* Gunnerus **ssp. *anglica*** G. Halliday

This subspecies of English Sandwort is endemic to the Ingleborough area of the Yorkshire Dales National Park. It was first discovered near Ribblehead station in 1889 by Lister Rotheray of Skipton but has since disappeared from there.

It is a very short, much branched annual or biennial. The numerous stem-leaves are oval or elliptic, 3-4 mm. long, and the white flowers are 12-14 mm. in diameter with two petals marginally shorter than the other three. It grows in humus-filled hollows in rocks and limestone pavement and along track-sides, where there is little competition from other

plants, and, less frequently, in damp, sheep-grazed grassland; associated species may include *Carex flacca, Minuartia verna, Festuca ovina, Sesleria caerulea* and, in wetter sites, *Primula farinosa*.

There are about 27 populations on the eastern side of Ingleborough and the number of plants varies considerably from year to year depending on climatic conditions. There are many more plants in wet years than in dry ones. This is shown in counts of six quadrats where, in July 2004, there was a total of 45 plants and in July 2007, which was a particularly wet year, there were 79 plants. In 2003, when all the populations were counted, there were 269 plants and in 2007 there were estimated to be over 1000 plants. (Walker 2007). The populations are able to recover after a number of dry summers which indicates that the seeds have a fairly long viability. The flowering season continues from May through to September.

The aim of the Arenaria Steering Group, with representatives from the Yorkshire Dales National Park, Natural England, the Botanical Society of the British Isles and local botanists, is to maintain the populations and protect the sites with the cooperation of landowners and managers. This involves regular monitoring, a slight reduction in grazing pressure and re-routing of the Pennine bridleway where necessary. Currently the plant is not under serious threat.

It is possible that the Ingleborough population of *Arenaria norvegica* ssp. *anglica* may have been isolated by retreating ice and have evolved slightly differently from *A. norvegica* ssp. *norvegica* which is a somewhat taller, perennial plant with smaller flowers and all petals the same length. This subspecies is limited in Britain to a few sites in north-west Scotland and some of the Hebridean islands and Shetland. It is rare in Norway and Finland but more common in Iceland.

Lady's-mantle – *Alchemilla glaucescens* Wallr.

Alchemilla glaucescens is widespread and fairly frequent in the Yorkshire Dales but elsewhere in Britain there are only four populations in NW Scotland. It is widespread in central and north-eastern Europe and less common in a few localities in Italy, Corsica and Fennoscandia.

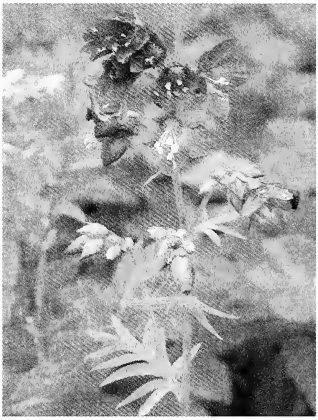
A. glaucescens is one of a group of perennial, apomictic microspecies of the *A. vulgaris* aggregate. It is easier than most to identify due to its compact head of flowers and the dense, silvery hairs on leaves, petioles, stem and pedicels. It occurs on hillsides in limestone grassland kept open by sheep grazing, alongside tracks and footpaths, and in hollows in limestone pavement; associated species include *Festuca ovina, Cynosurus cristatus, Lotus corniculatus, Bellis perennis, Plantago lanceolata, Sanguisorba minor, Ranunculus bulbosus* and *Trifolium repens*.

Although all its natural sites are on limestone it has been shown that, where seed has

been carried with limestone chippings to create paths on more acidic substrates, it will thrive and spread away from the limestone.

Jacob's Ladder – *Polemonium caeruleum* L.

Jacob's Ladder is an attractive plant growing to 50-70 cm. tall with pinnate leaves and deep blue flowers 2-3 cm. in diameter. It occurs, as a native plant, in four sites in the Yorkshire Dales. In three of them it is below a limestone scar on a steep N- or W-facing slope grazed by sheep in winter; the fourth is an inaccessible scar ledge on the west side of Pen-y-ghent. Its main stronghold in Britain is in the Derbyshire Dales where it grows in similar situations or beside streams, as it does in its two Northumberland sites. In Europe it is distributed across northern and central montane areas.



The native plants have larger flowers of a more intense blue than those which have escaped from gardens and can sometimes be found on roadsides or waste ground.

P. caeruleum grows in moist soils in tall herb communities in association with *Filipendula ulmaria, Dactylis glomerata, Arrhenatherum elatius, Geranium robertianum* and *Mercurialis perennis*. It flowers from June to August and is pollinated by bumble bees. It is a relatively short-lived perennial and reproduces by seeds which are released through the autumn and winter. They remain fairly close to the parent plant so that there may be many plants within quite a small area. It is grazed by mammals but appears to be immune to molluscan predation.

Prickly Sedge – *Carex muricata* L. ssp. *muricata*

In Britain this subspecies of the Prickly Sedge is limited to seven sites in Gloucestershire, North Wales, Shropshire and Yorkshire. It is widespread through northern and central Europe and most frequent in Scandinavia and eastern Europe.

In VC 64 it occurs in two sites. In Gordale it is in typical CG9, *Sesleria caerulea – Galium sterneri* grassland below a limestone scar on an open, steep SE-facing slope. It grows in small tufts c.20 cm. tall. Its more rigid, erect flowering stem and its dark red-brown female glumes distinguish it from ssp. *lamprocarpa* which has pale brown glumes. The population at Gordale has increased from four plants with two flowering spikes in 1985 to 39 plants with 185 flowering spikes in 1999. This is due largely to the fact that rock climbing on the scar above has been banned and therefore trampling reduced. Summer grazing has also been reduced but some grazing is essential to prevent the sedge being overwhelmed by competing grasses. The other site at Ribblehead is atypical in that it is in wooded limestone pavement, which is in itself a rarity. Attempts are being made to increase this very small population by opening up the tree canopy and protecting the plants against grazing by wild mammals.

Once conditions have been improved the populations are able to recover which indicates that the seeds have an adequate viability.

Thistle Broomrape – *Orobanche reticulata* Wallr.
Thistle Broomrape is uncommon but can be found in much of southern and central Europe across to Asia. In Britain it occurs in 27 known sites within three metapopulations, all of which are in Yorkshire. One of these is on the Magnesian limestone in the vicinity of Ripon. The second, also on the Magnesian limestone, is between Wetherby and Leeds, and the third is on chalk in east Yorkshire.

It was first found in Britain at Hetchell Wood, now a Yorkshire Wildlife Trust Reserve, in 1902 by J. F. Pickard but not distinguished from "*O. major*", an old name for both *O. rapum-genistae* and *O. elatior*, until 1908 when it was found, again at Hetchell Wood by H. E. Craven. It was then sent to Dr Gunther Beck-Mannagetta in Prague for determination.

It is a monocarpic parasite on the roots of thistles, believed to be pollinated by a wide range of bee species. When first found it was on *Cirsium eriophorum* but it will grow on other species of thistle. Its more usual host is *C. arvense* which is perennial and therefore always available, whereas most other species of thistle are biennial. Germination is triggered by a chemical stimulant in the roots of the host plant. A filamentous growth is produced by which it is attached to the younger, more penetrable roots of thistles from which it obtains its nutrients. It may weaken its host but rarely destroys it. *Orobanche reticulata* is fairly susceptible to predation by slugs and the new spikes may occasionally be eaten by mammals. It can be something of a problem for farmers to have a protected plant dependent on a serious agricultural weed.

The Magnesian limestone is in a lowland area where the rainfall is less than in the Dales. The soils are generally a sandy loam. Here there is less leaching and evaporation of moisture leaves a higher mineral content in the upper soil horizons. The high nitrogen and phosphate levels give rise to a lush growth of vegetation and the *O. reticulata* sites are generally composed of the MG1, *Arrhenatherum elatius* grassland; the most frequent associated species, throughout the range of sites, are *Cirsium arvense, Glechoma hederacea, Dactylis glomerata, Urtica dioica, Rubus fruticosus, Festuca rubra* and *Ranunculus repens*. If the vegetation becomes too dense at a site the population of *Orobanche reticulata* will diminish. One stem may hold up to 50 flowers and a mature capsule may hold over 2000 seeds which can be dispersed by wind or water or, possibly, mammals (Hughes & Headley 1996). It is essential in dense grassland that the ground is disturbed in some way to enable the tiny, dust-like seeds to make their way through the soil to reach the roots of a thistle. The majority of its sites are in fields alongside rivers and disturbance may be effected by occasional floodwaters. Elsewhere winter grazing or rabbit scratchings serve the purpose. Where it occurs in reserves the management may include sheep grazing and scrub clearance. The seed is known to be viable for many years so when conditions are right there will be a resurgence in the number of plants at a site.

It is interesting that although thistles are ubiquitous, they only host this parasite when growing on calcareous substrates.

Conclusions

As far as one can generalise, the above-mentioned plants seem to be poor competitors and grow where competition from other species is reduced. The Yorkshire Dales are distant from industrial and urban pollution, which would increase nitrogen levels and, in addition, the nitrogen in the soil is neutralised to some extent by the calcium in the limestone. The rare plants have evolved to tolerate low levels of nitrogen which is essential for plant

growth. They can thrive here and the usually more strongly growing species, which on richer soils would out-compete the rarities, are held back. It is not clear to what extent the calcium itself is necessary to the plants since the soils for the most part have a pH a little below 7. It would be necessary to analyse the soils and the plants to find out which chemical elements are essential to each of the species and to what extent. Experiments of this kind are being undertaken so that one day these questions will be answered.

Some of these rare plants are on steep slopes which may be somewhat unstable due to soil creep or to disturbance caused by freezing and thawing so that the soil surface is opened giving the seeds a chance to germinate and the plants to become established. The plants which grow on more level ground occur in rocky sites or beside tracks where, again, competition from other vegetation is reduced. In upland situations, where the temperature is lower than elsewhere, a plant's photosynthetic rate is reduced; therefore growth is slower and the resulting mass of vegetation is likely to be less dense. In some species plant height is reduced by exposure to increased ultra-violet light experienced in open, upland situations (Good & Millward 2007).

In these open situations the ground is kept sufficiently moist by a high level of rainfall, but it is well-drained, the water carrying with it essential nutrients and fragments eroded from adjacent cliffs and rocks. The low level of nitrogen and a higher level of phosphate in these light soils appear to suit all these species. The perennial species have a fairly substantial root system where excess carbohydrate, produced during the growing season, can be stored and used during the following winter and spring.

Several factors are working together to suppress excessive growth which gives the less competitive species a better chance of survival. Each of these factors is beneficial to some or all of our rare species. Yet they remain rare. Reasons for this may include a lack of suitable pollinators, wastage of seeds due to predation, or failure to arrive in a suitable situation for germination. They all reproduce by seed and therefore need a site where the seed is able to germinate and the plant develop without being overwhelmed by more strongly growing competitors.

Acknowledgements

I am grateful to Brian Burrow, Alistair Headley, Albert Henderson and Howard Rockley for their helpful comments and suggestions.

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THE TWO BRITISH *ALEURITIA* PRIMROSES: 2. LIFE AND DEATH MATTERS

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INTRODUCTION

In this article, an attempt is made to provide some insights into the life, and particularly the death, of the two British *Aleuritia* Primroses, Bird's-eye Primrose (*Primula farinosa*) and Scottish Primrose (*Primula scotica*), both in the wild and under cultivation*. Such insights are based on personal observations of cultivated plants of both species, on my own observations of *P. farinosa* in the wild, and on my interpretations of available literature on plant morphology populations and ecology. *P. farinosa*, which is very widely distributed in the Old World, and *P. scotica*, with a very small endemic range, are both perennial species with *potentially 'everlasting'* individual plants, genets or clones. A rhetorical question may be asked: does any genet die of 'old age'? Draining of mineral resources or of water from the immediate environment of a plant can, obviously, cause death at any life stage. However, it also seems likely that holistic, and lethal, malfunctioning of a plant, or its parts, may sometimes occur, and somehow be brought about by its environment. Such malfunction may be precipitated by mismatch between phytohormonal control of development and available resources. Such a mismatch is more likely to occur under cultivation, and in a rapidly changing climate, than in a stable natural habitat approximating that of the past.

LIFE AND ITS CONTINUANCE

Fitness and Survival

Genets of both Primroses have been recorded as surviving for many years in wild populations; see Hambler and Dixon (2003) and Bullard *et al.* (1987) for relevant literature on each species. Populations of both of these copiously seeding species suffer many casualties in the wild, yet populations may remain almost stable (see Bradshaw 1981 regarding *P. farinosa* in Teesdale); these are usually recorded simply as statistics in population studies, with the causes of 'loss' of many individuals being unknown. In a demographic study Toräng (2007) demonstrated that seed dynamics (formation, survival and germination of seeds) were more important for increasing a local population of *P. farinosa* than survival of seedlings and adult plants. Extrapolation of this observation leads to the conclusion that the continued existence of a long term and wider metapopulation of this species is dependent on these dynamics.

Whilst populations of both species are dependent upon seeding for their long-term survival, Tremayne and Richards (2002) demonstrated that relatively heavy seeds, among those produced by the obligately outbreeding *P. farinosa*, gave enhanced 'fitness' among seedlings planted out in the wild, an effect lasting for two years; however, this was not so for *P. scotica*. Such fitness, they conclude, is not heritable, but is based on resources appropriated from the parent plant by embryos after fertilization – fewer ovules fertilized means more resources per embryo: fertilization success is a result of a series of stochastic processes involving external factors such as insect visitation, itself affected by the weather. It follows that a poor pollinator year for *P. farinosa* might sometimes result in nutritionally better equipped seedlings in the following year. It is worth mentioning that 'fitness' is used in its true Darwinian sense, implying suitability at every stage of development for the existential environment, rather than robustness or vigour with any 'keep fit' implications. Plasticity, itself an heritable attribute, has its own survival value (see Fig. 1, and text below).

* Unless otherwise stated, plants have been grown outside in plastic troughs with built-in water reservoirs, and rooted in a peat based compost.

Reproductive Effort

Both species are iteroparous (i.e. their genets spread their reproductive effort over time, producing several overlapping, seasonal flushes of flowering; they also flower over a number of years). According to Toräng's (2007) interpretation of relevant literature, there is an expectation that optimal flowering time should be dependent on the mutualists – flowering phenology may be tuned to maximize exposure to pollinators. This may well be so in the obligatory outbreeder *P. farinosa*: it is possible that other factors override this presumed imperative for the facultatively self-pollinating *P. scotica* in which disturbance of a flower by, for example, wind must be presumed sufficient to transfer pollen from anthers to a stigma at the same level. For both species, seed production must be accomplished before falling temperature and decreasing illumination terminate 'profitable' photosynthesis. This point of unprofitability has been arrived at some weeks earlier in the year for *P. scotica* than for *P. farinosa* when the species have been cultivated together, out-of-doors in Bradford (53°47'N, 1°45'W), in a 'habitat' that is unnatural for each.

Storage and Translocation of Metabolites

Flowering and seeding depends upon (a) complex phytohormonal controls directing both phyllotaxy (the complex arrangement of leaf primordia, in several spirals or parastichys), and organogenesis just below the apical meristem of any shoot, and (b) appropriate timing; it is for example inappropriate for an inflorescence to be initiated without a sufficient supply of carbohydrate for its entire development being already present in, *or guaranteed by*, older organs below it on the axis. The green 'bulb' leaves are such organs, expanding as the inflorescence emerges. By the beginning of their second growing season, both species should have such a supply. An initial supply is evident in a transverse section through the midrib of a living 'bulb' leaf (Fig. 2) In this section some mesophyll cells are packed with blue iodine-stained starch grains, whilst others have large vacuoles of the uniform golden colour characteristic of tanniferous cells; here, as Esau (1962) commented, starch and tannins are apparently mutually exclusive cell constituents. Neither the extremely complex chemistry nor the precise function of tannin have been elucidated in the *Aleuritia* primroses, although tannins are recorded elsewhere in the genus. As Zucker (1983) notes, plant tannins are not known to have any physiological function, and he discusses their likely roles in plant defence against pathogens and herbivores. Primroses of the section *Aleuritia*, incidentally, are unusual in the genus in not producing volmitol, an important chemotaxonomic marker and the major nonstructural carbohydrate in the leaves of other sections of the genus (Häfliger *et al*. 1999).

Starch is also abundant during winter: (a) in the parenchyma of the thick white adventitious roots (shown in Fig. 3) produced in the first (and every subsequent year of growth), and (b) in the axis. An additional potential supply (c) is guaranteed – at first as the green 'bulb' leaves below the inflorescence expand to form a photosynthesising rosette. Later these same leaves and any of the previous season's roots remaining change colour and die. The leaves first become yellow and the roots first become brownish and then translucent (Fig. 5); it must be assumed that resources have been translocated upwards before death, and subsequent decay, of these and of the oldest part of the shoot axis.

Annual Cycles of Growth and Decline

As a green photosynthesising scape matures, turning yellow, it must also be presumed to relinquish resources to the developing seeds. Survival of the axis into a subsequent reproductive phase then depends upon a new generation of adventitious roots, most originating endogenously from the youngest part of the axis – that is, above the base of the inflorescence. New roots are particularly evident soon after leaf expansion begins, and root production continues throughout the summer and into autumn. Although the roots, and part of the axis, originating in any growing season persist throughout the following winter, they perform one last function after the first flush of flowering, anchoring the shoot until a new generation of adventitious roots takes over.

Abundant tanniferous and sclerenchymatous cells may temporarily, and advantageously, delay decomposition of roots and axis: references in the literature to delay in decomposition when plant tissue becomes litter, either in the soil proper, as in roots, or on the soil surface as leaves have been provided by Zucker (1983). Such delay is evidenced by the persistence of erect dead scapes, now fused to the axis, bearing dehiscent fruits throughout the winter. Seed-shed is thus spread, perhaps advantageously, over a long period. Seedlings of both species have been found in January among the litter (of Bradford-grown genets) very close to the parent axis (see Fig. 5); such new individuals might, particularly in the field, be later mistaken for ramets. Even after their death the various morphological components of the primroses enhance survival of the species.

Commitments

A group of meristematic cells on or near the adaxial surface of a leaf rudiment very near the apical meristem is at some time committed to produce an inflorescence which then 'arises' from the leaf surface; the scapes of such inflorescences are embedded in the developing leaf rudiments (Fig. 6). The timing of this commitment is uncertain, but has certainly occurred well before a recognizable inflorescence emerges in spring, *appearing* central to the expanding rosette. The fulfilment of this destiny depends upon the available stored resources, and must be influenced by external factors. Inflorescence primordia (sometimes aborted) are recognizable in some overwintering 'bulbs' of both species. It appears likely that the chemical trigger is phytohormonal and endogenous, that it might operate at any time of the year, and that only one leaf at a time in a given ontological sequence is usually affected. Development of an inflorescence primordium is likely to be temporarily curtailed as temperatures fall in autumn, and an evident 'waste' of resources occurs when this constraint is modified (Fig. 4) in a warm autumn.

Shoot primordia are initiated in a similar fashion on leaf surfaces sometimes even proximate to an inflorescence (see Fig. 3), but they may also appear *de novo* elsewhere on the axis. The location, or migration, of axillary meristems to leaf surfaces in some, unspecified, plant species was mentioned by Esau (1953), but no reference germane to *Aleuritia* Primroses has been found. Axillary shoot formation was studied in *Stellaria media* by Tepper (1992) who described spiral shoot placement tending to show spiral anisoclady, but remarked that the reason why buds form in some [leaf axils] but not others is not understood: the same must apply to *Primula* species.

Performance Plasticity and Adaptation

The performance of any inflorescence, in particular the number of flowers in its umbel, is limited by the existential resources of its rosette – a flowering rosette of *P. farinosa* may be induced in shallow soil to assume the small stature and limited flower number of *P. scotica* without in any way appearing unhealthy or lacking in 'vigour' – thus producing a 'phenocopy' (Fig.1) of its Scottish relation. Under glasshouse cultivation, *P. scotica* has

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FIGURE 3 (overleaf)

Primula farinosa second season rosette (glasshouse grown) on 1 September 2005. Thick white roots are emergent through the brown remains of leaves at the base of the rosette, and through the bases of living leaves immediately above. An association between a leaf axil and a scape is obvious, as is that of a tiny shoot with the base of the scape. The first post-inflorescence leaf is recognisable by its exposed silvery underside: the shoot apex is hidden at its base.

FIGURE 4 (overleaf)

Primula farinosa genet on 9 August 2007 with multiple ramets: A = juvenile inflorescence (too late for completion of flowering and fruiting); B = developing winter 'bulb'; C = dead scape (bearing capsules, not shown).

FIGURE 1.
(a) *Primula farinosa* genet, at first flowering, produced in an unheated glasshouse by cultivation in shallow compost with sporadic watering, and representing a 'vigorous' phenocopy of (b) a similarly cultivated and 'vigorous' *P. scotica* genet resembling its conspecifics in the wild.

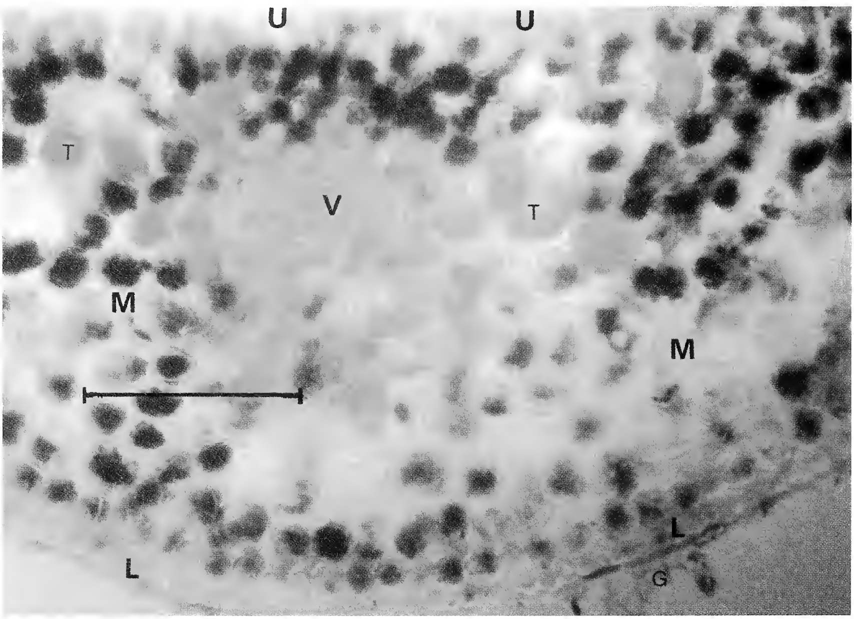


FIGURE 2.
Hand-cut transverse section through basal region of a living 'bulb' leaf of *Primula farinosa* treated with aqueous iodine solution showing mesophyll cells packed with blue-stained starch grains. U = adaxial epidermis (unfocused), L = abaxial epidermis with glandular trichomes (G), V = proto-vascular tissues (procambial strand); M = mesophyll tissue; T = some of the tanniferous cells of the mesophyll individually identified. Scale bar = 100μm.

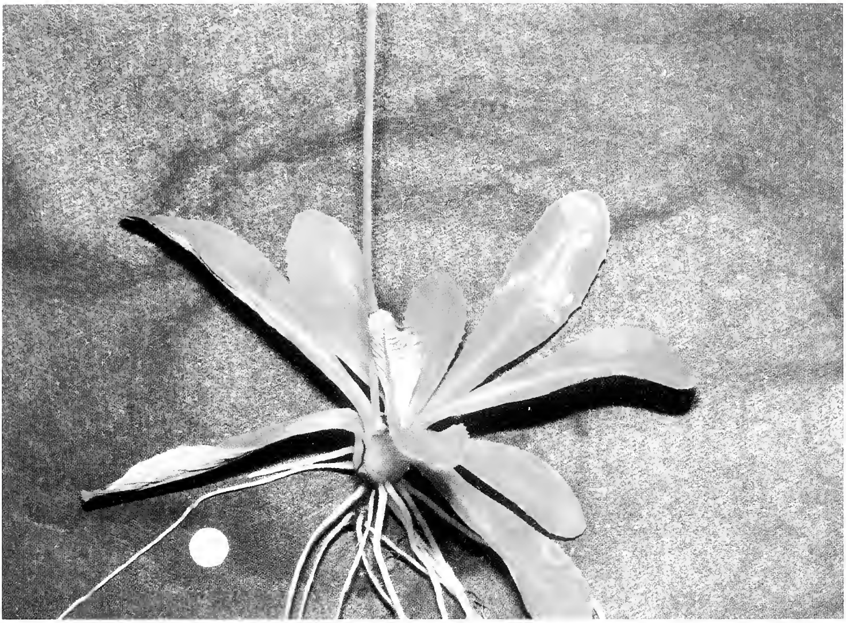


FIGURE 3.

FIGURE 4.

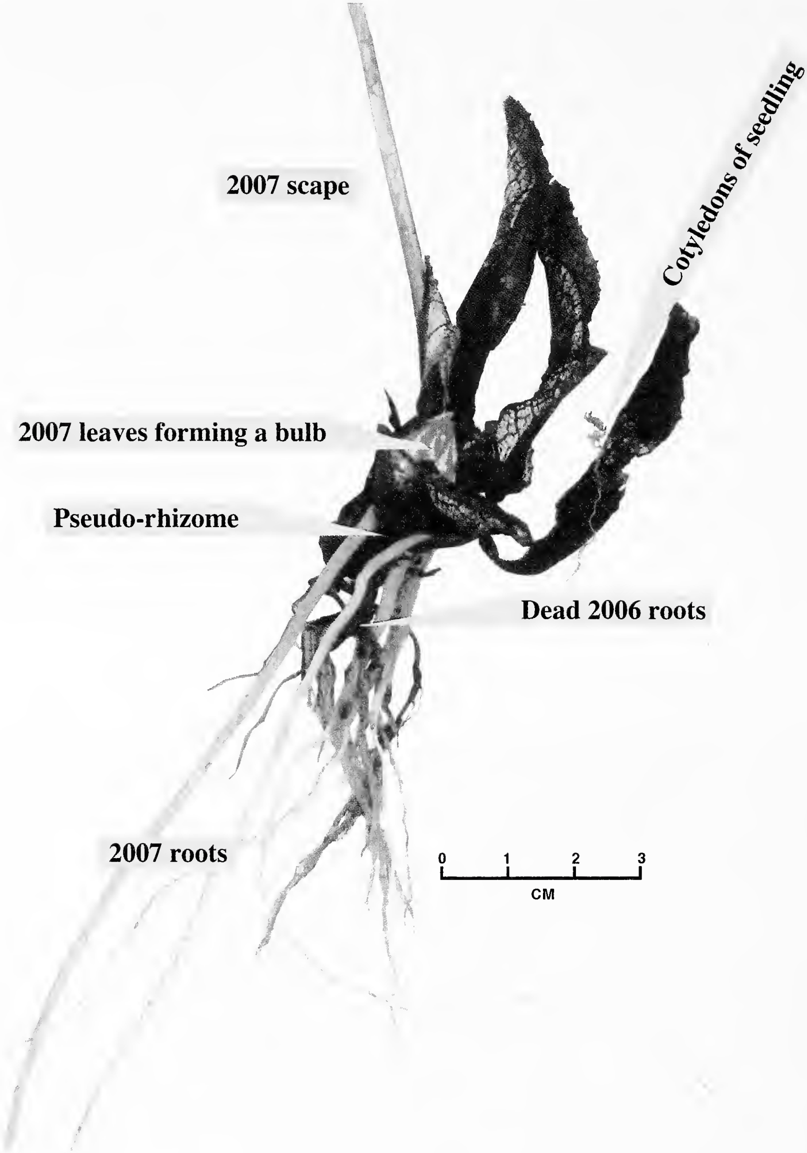


FIGURE 5.
Two years in the life of a *Primula farinosa* ramet (photograph taken 24 January 2008): the pseudo-rhizome comprises the decay-resistant dead axis and leaf bases of 2006 and previous years, and is the anchor for the 2007 scape; leaves produced in 2007 comprise those destined to expand (now dead), and those whose allometric expansion has been temporarily curtailed – the 'bulb' leaves. A seedling with a cotyledon spread of c.1.5 mm. (just below the label) illustrates germination among the litter.

been observed to exist as large, blowsy plants, proliferating vegetatively and with little, if any, resemblance to the wild plant (Elaine Bullard *in litt.*) Both plants illustrated here were grown in very shallow compost that was occasionally allowed to dry out: *P. scotica* approximates the appearance of wild plants, whilst *P. farinosa* is at the smaller end of its size spectrum in the wild.

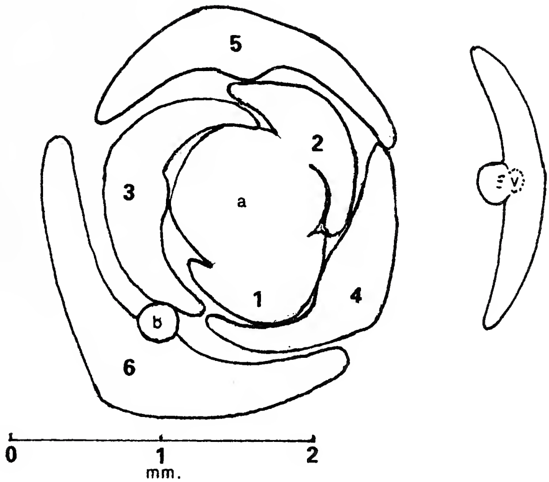


FIGURE 6.
Primula farinosa: Left: Map of a hand-cut transverse section of a 'bulb' in winter suggesting a complex phyllotaxy (leaves in more than one helix or or parastichy around the axis); one leaf rudiment bears an inflorescence scape partly embedded in its adaxial mesophyll; their epidermal layers are continuous: (a) = centre of axis, (b) = centre of scape. Leaf rudiments are numbered in age sequence, the youngest is fused to the axis except at its margins. Right: Map of a single 'bulb' leaf in transverse section with signs of a developing link between its procambial (vascular) strand and that of an emergent scape.

Some *P. scotica* 'new arrivals' rosettes in an Orkney population survived for up to eight years and died without flowering (Bullard *et al.* 1987); this, it was concluded, might be because older plants which flowered were genetically superior as a result of their conception in peak flowering years, when there would be a greater possibility of outcrossing and renewal of heterozygosity. This, however, suggests that the phenomenon of heterosis or 'hybrid vigour' might be involved, with the non-flowering plants suffering from inbreeding depression. It has long been accepted that such depression (see, for example, Hovanitz 1953) can only be induced in *normally outbreeding* organisms; it therefore seems unlikely to occur in a species adapted to a self-fertilizing system for many generations. Their alternative hypothesis involving prime sites seems more acceptable. Just as overproduction of inflorescences may be evident in cultivated specimens, the converse may sometimes be true elsewhere.

Timing

Flowering of *Primula* species is popularly assumed to be a process initiated by an environmental trigger operating in the spring, and the timing of emergence of the

inflorescence and of floral display is easily recorded. However, the process begins in the primroses with *commitment* of a small meristematic region near the adaxial surface of a leaf rudiment close to the shoot apex. The 'moment' of commitment cannot be known, but it is likely to be a result of endogenous phytohormonal changes controlled by the shoot apex, and adjacent leaf primordia.

Any juvenile inflorescence, of either species, appears to have emerged from the centre of its rosette, although a single silvery adaxial leaf surface adjacent to the scape may sometimes reveal that the true apex, with its growing tip, is to one side of the shoot apex. This is shown in Figure 3 where the down-curled (revolute) edges of the first post-inflorescence leaf are evident; such an arrangement is suggested on some published line drawings. The apparent centrality of the inflorescence is lost as flowering reaches its maximum, with the base of the scape firmly attached to the axis, with living foliage above, and senescing, dead and decayed leaves below it. As this inflorescence matures it seems likely that a leaf rudiment higher up the axis has already been committed as the site of a new inflorescence. This may produce the second flush of flowers on the axis, or the process may simply abort at any stage.

Inflorescences emerging too late in the year are an evident waste of resources; such waste may be observed under cultivation (Fig. 4), but has not yet been reported in nature. As climate change progresses such inappropriate seasonal responses may become more prevalent.

Exhaustion – Flowering to Death

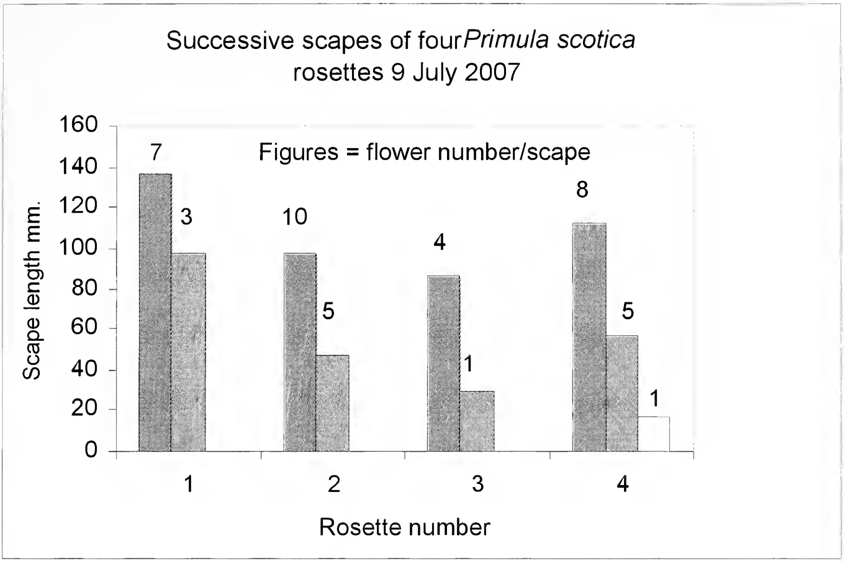
That the resources of the Primrose plant are being depleted by normal operation of the process which produces more than one flush of flowering is suggested by Figure 7 which illustrates the decreasing flower number and length of the scape of successive inflorescences produced by genets of *P. farinosa* and single rosettes of *P. scotica* in their second flowering season. In order to survive and flower in a subsequent year a shoot meristem must have produced a 'bulb' by the end of the growing season. If the shoot or ramet has flowered this must be above its latest inflorescence (as in Fig. 5) – if not it will have, in the words of Bullard (1976), flowered itself to death. As she observed, this happens to plants under cultivation even in Orkney.

This is obviously the case in the specimen of *P. scotica* illustrated (Fig. 8): it produced three scapes which, after the rosette had died and rotted, were linked at their bases. In the illustration the configuration of the decay-resistent heavily lignified bases of the scapes suggest that the primordial meristem of one may have originated on the base of its precursor. In this instance it seems likely that an environmentally induced malfunction had occurred in the hormonal message system that usually (but maybe not always) inhibits floral initiation at the shoot apex or for a set number of leaf primordia after the last.

Bullard *et al.* (1987) found no evidence in their field studies of an increased probability of dying [immediately] after flowering. Here some proximate explanations are sought for the death of *Primula* genets that have been subjected to no discernible adversity. The final explanations are, of course, genetic, selective and unavailable, but it is suggested below that the growth-form of these Primroses must, of itself, ultimately prove lethal to a rosette.

Death by Habit

Both species have an erect, albeit very short, shoot axis with only the topmost few millimetres alive; it plainly cannot continue upward growth indefinitely, yet allow the, obviously adaptive, ground-hugging hemicryptophytic habit to be maintained. Both species produce lateral shoots, and are able to regenerate if the apical meristem of an established shoot is destroyed. Such emergency regeneration, by development of lateral buds, was recognized long ago (Wardlaw 1951) as a general characteristic of flowering plants, and depends upon detached meristematic areas. When phytohormonal inhibition of lateral outgrowths is relieved through apical damage or simply by increasing distance from the



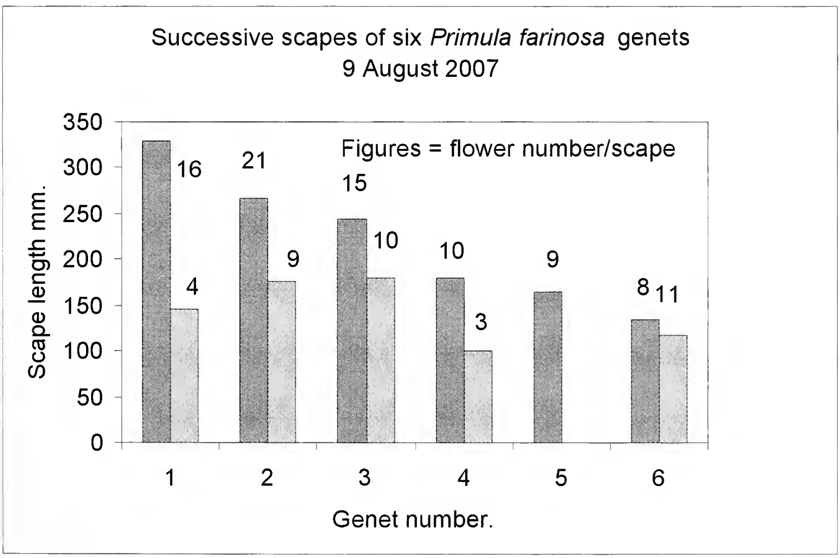


FIGURE 7.
Histograms illustrating a decline in performance of successive inflorescences of two *Primula* species.

apical meristem, a detached meristematic area may become, in Wardlaw's words, 'a self determining region, capable of forming a new axis, new lateral members, and a vascular system without the help of older preformed organs and tissues provided an adequate supply of nutrients (including carbohydrates and other metabolic substances) from below is maintained'. Water is also essential: if any lateral shoot is to survive as an independent ramet it must have access to the soil: a dead erect primary axis is ultimately unconducive to such access.

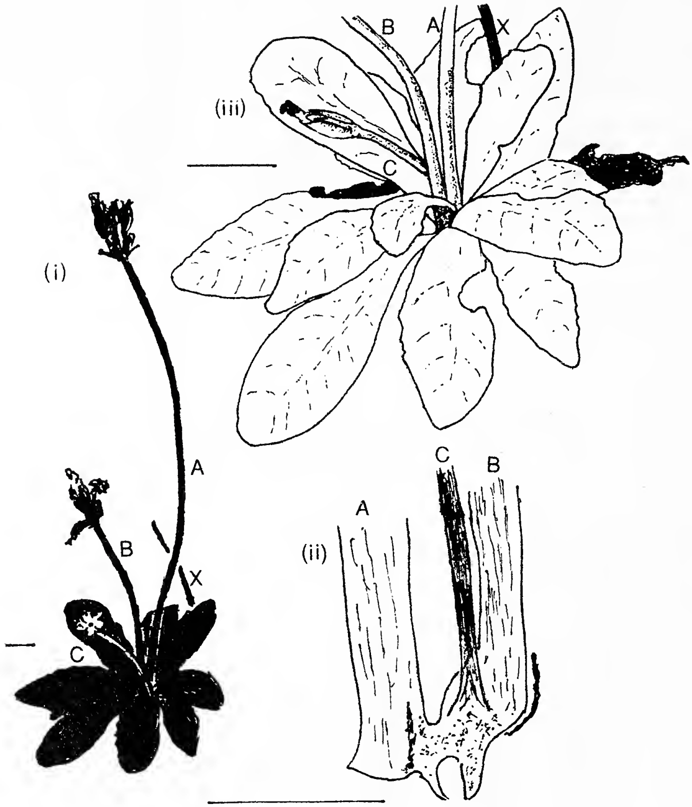


FIGURE 8.
(i) Representation of a rosette of *Primula scotica* (no. 4 of Fig. 7), with one flower remaining, during first week of July 2007 – uniaxial genet from seed germinated in 2005; (ii) Interpretative drawing of the dried conjoined basal regions of the three scapes in January 2008. Scale bar for each drawing = 10 mm. (iii) Drawing of the same rosette on 9 July 2007. X = solitary scape produced in 2006 dead, still attached to dead lower part of axis; A = yellowing scape of first 2007 inflorescence (8 flowers borne, 2 capsules ripe; length attained 112mm); B = green scape of second 2007 inflorescence (5 flowers borne; 4 green ripening capsules, with wilting corollas still present), length 56 mm; C = Green scape (one flower borne, wilting corolla present), length 17 mm.

Conclusion

Primula scotica produces relatively few new shoots, i.e. potential ramets, in its lifetime. Every ramet of either species surviving into the next season as a 'bulb' is, exactly like the maiden rosette, potentially able to produce at least one inflorescence without outrunning its resources and thereby killing its own shoot apex. Genets of *P. scotica* cultivated outdoors in Bradford were shown (Hambler 2007) to produce more inflorescences (typically two) in their first year of flowering than corresponding *P. farinosa* genets (typically one). With its potential for more prolific vegetative increase, however, *P. farinosa* had produced up to eight vegetative shoots, compared with a maximum of three for *P. scotica*. A ramet of *P. farinosa* can also exceed its resources by flowering late in the season: remnants of a cohort of this species flowered into December in 2007 whilst *P. scotica* was over by mid-August. Such unproductive and lethal flowering is perhaps less likely to precipitate the loss of an entire genet in the former species. It is evidently brought about in cultivation by a mismatch between genetic imperatives and microclimate. Such a mismatch in the wild on a larger scale (which could be imminent) might adversely affect entire populations of either species, as might an inability to flower such as that reported by Bullard *et al*. (1987) for 'new arrivals' in an Orkney population of *P. scotica*. Hypothetical explanations for both lethal-flowering and non-flowering have been offered: they require testing, and any unusual behaviour of the British *Aleuritia* primroses in nature (such as that frequently reported for other *Primula* species in letters to newspaper editors) deserves attention from naturalists.

Acknowledgement

I am grateful to Elaine Bullard for helpful conversations about the Primroses and for her provision of the major topic of this article.

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BOOK REVIEWS

Yorkshire Rocks and Landscape: a field guide edited by **Colin Scrutton** and John **Powell**. Pp. 224, incl. 65 b/w maps, geological sections, photographs and other illustrations. 3rd edition. Yorkshire Geological Society. 2006. £9.99, plasticised card covers.

Northumbrian Rocks and Landscape: a field guide edited by **Colin Scrutton**. Pp. 216, incl. 77 b/w maps, geological sections, photographs and other illustrations. 2nd edition. Yorkshire Geological Society. 2004. £9.99, plasticised card covers.

Available from: Dr J.Powell, c/o British Geological Survey, Kingsley Dunham Centre, Keyworth, Nottingham NG12 5GG; cheque to incl. £2.00 p. & p. payable to 'Yorkshire Geological Society'.

These two c. A5 sized publications complement each other, providing highly informative guides to the geology, landforms, rocks, minerals and fossils of north-east England from just south of Sheffield to slightly north of Berwick upon Tweed. The Yorkshire volume covers the historic county of Yorkshire, whilst the work on Northumbria provides information on Northumberland, Durham, Tyne and Wear, and Cleveland north of the River Tees.

Both books commence with a general introduction to the geological history of the area to provide a framework for the detailed information about the numerous carefully selected geological sites described in the main body of the work. The Yorkshire volume contains 21 detailed itineraries and the Northumbrian volume 17, each written by professional geologists to a standard format. Each itinerary has been chosen to illustrate key geological attributes of the geology of northern England and to provide a geographical spread of sites throughout the area.

Though written by experts, the technical nature of the information has been made accessible to the non-geologist by using bold typography in the text for most technical terms and then providing a glossary at the end of each volume clearly explaining them.

Detailed maps, sections and other illustrative material are provided to show the location and characteristics of each itinerary, with information on how to gain access to each site and on the most relevant Ordnance Survey and British Geological Survey maps. General information concerning aspects of safety appropriate to each site is provided and advice on where tide tables relevant to the various coastal geological sections may be obtained, though oddly no mention is made of the UK Hydrographic Office website: http//easytide.ukho.gov.uk

The itineraries range from the simple and easily accessed sites, where a visit could be completed in less than an hour, through to major excursions that would take the better part of a full day. Each itinerary is abundantly furnished with national grid references, which, in conjunction with the sketches and maps in the books, should guide the visitor to the geological features that are discussed in the text.

The books are robustly produced and suitably sized for use in the field. Both volumes provide a substantial amount of information on local museums where additional geological information may be found and include references to selected detailed published papers. These volumes provide an excellent guide to the geology of landforms of North East England and are likely to be of interest not only to geologists, but to geographers, biologists and other people who take an active interest in natural history.

DEC

REVISITING THE SOLITARY WASPS AND BEES (HYMENOPTERA: ACULEATA) OF BURTON LEONARD LIME QUARRIES AND DUNCOMBE PARK IN WATSONIAN YORKSHIRE

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Studies of the aculeate wasps and bees of Burton Leonard Lime Quarries and Duncombe Park have been published (Archer, 1993, 1997). Recording at these sites stopped when few new species were being found, the assumption being that as only a few species at most remained to be found, a write-up of the sites was appropriate. However, since publishing these two papers, non-parametric statistical procedures have become available for estimating how many as yet unrecorded species may be present on a site. Therefore, the first aim of this paper is to apply these statistical procedures to previous data (Archer, 1993, 1997) as well to data from further sampling carried out during 1999 and 2002-2003 to determine if the decision to stop recording at these sites was justified. Furthermore, since these two papers were published, a national quality scoring system has been developed (Archer 1999, 2002). Therefore, the second aim of this paper is to apply this scoring system to the full sets of data from the two sites.

Descriptions of the two sites are given in Archer (1993, 1997); no noticeable changes have been found at Burton Leonard while at Duncombe Park some dead wood has decayed and other dead wood resources have become available.

Sampling methods

The sampling methods are given in Archer (1993, 1997). For Burton Leonard, the dates for the first 16 visits between 1978 and 1994 are referred to as the first sample. During 1999, a further four monthly visits were made from April to July. The data from the 20 visits of the first sample and 1999 are referred to as the second sample. During 2002-2003, a further six monthly visits were made from March to August. The data from the 26 visits of the second sample and 2002-2003 are referred to as the third sample.

For Duncombe Park, the dates for the first 14 visits between 1985 and 1990 are referred to as the first sample. Archer (1993) indicated that only 13 visits were made; this is an error, since two visits were made during April. During 1999, a further five monthly visits were made from April to August. The data from the 19 visits of the first sample and 1999 are referred to as the second sample. During 2002-2003, a further five monthly visits were made from April to August. The data from the 24 visits of the second sample and 2002-2003 are referred to as the third sample.

New species recorded

Four new species were recorded from Burton Leonard during 1999 (*Pseudomalus auratus* (Linn.), *Crossocerus nigritus* (Lepeletier & Brullé), *Andrena subopaca* Nylander & *Sphecodes gibbus* (Linn.)) and nine new species during 2002-2003 (*Priocnemis exaltata* (Fab.), *Crossocerus annulipes* (Lepeletier & Brullé), *C. elongatulus* (Van der Linden), *C. distinguendus* (Morawitz), *C. capitosus* (Shuckard), *Ectemnius sexcinctus* (Fab.), *Hylaeus confusus* Nylander, *Andrena synadelpha* Perkins & *Nomada rufipes* Fab.). The records of *C rossocerus distinguendus* and *Andrena synadelpha* were new or recently new species for Watsonian Yorkshire.

Eight new species were recorded from Duncombe Park during 1999 (*Pseudomalus auratus* (Linn.), *Priocnemis schioedtei* Haupt, *Crossocerus nigritus* (Lepeletier & Brullé), *Rhopalum coarctatum* (Scopoli), *Andrena cineraria* (Linn.), *Lasioglossum leucopus* (Kirby), *Sphecodes hyalinatus* von Hagens & *Nomada goodeniana* (Kirby)) and one new species during 2002-2003 (*Ectemnius ruficornis* (Zetterstedt)).

Daily rates of recording solitary species

The daily rates of recording species of solitary wasps and bees per month are shown in Table 1. The month with the highest rate was June for Burton Leonard and July for Duncombe Park.

Table 1.

The number of species of solitary wasps and bees recorded per monthly visit for Burton Leonard Lime Quarries and Duncombe Park (range in brackets)

	March	April	May	June	July	August	September
Burton Leonard	2	8.5	9.8	17.8	11.6	9.8	3
		(4-11)	(5-12)	(12-24)	(5-15)	(8-12)	
Duncombe Park		5.5	11.6	11.6	16.8	13.5	13
		(2-11)	(6-18)	(9-15)	(8-26)	(7-20)	

Estimating the potential number of solitary species

The non-parametric statistical procedures used were the presence/absence Chao (in Colwell & Coddington, 1994) and the first order Jackknife (Heltshe & Forrester, 1983). The presence/absence quantitative estimate of Chao is based on the number of species that are recorded in one (singletons) or two (doubletons) samples. The Jackknife estimate of Heltshe and Forrester is based only on singletons. Because some aculeate species are only active in the spring or summer it is advisable that sampling is distributed throughout the months of adult activity. The software to carry out these statistical procedures was provided by Pisces Conservation Ltd. In practice the software takes 1, 2, etc. samples at random, each time calculating a mean estimate of species richness. The procedures were repeated 50 times for the first, second and third samples from the two sites. With a small number of samples the estimates are erratic, but as more samples are selected these may stabilise, giving confidence in them.

The species diversities estimates for the two statistical procedures are given in Figs 1, 2, 3, 4 and the final species diversities estimates after all the visits are shown in Table 2, 3. For the first sample for Duncombe Park, the species diversity estimates stabilize, but the final species diversity estimates differ considerably from each other, indicating that recording should not have ceased with the first sample. The second samples, which include further visits, show on analysis that the species diversities stabilize, but at a higher level,

Table 2.

Non-parametric estimates of species richness at Duncombe Park

	Chao estimate	Jackknife estimate
First sample		
No. species recorded	62	62
No. species estimated	75	81
95% confidence limits	62-88	70-92
% estimated species recorded	82.7	76.5
Second sample		
No. species recorded	70	70
No. species estimated	86	90
95% confidence limits	70-102	79-101
% estimated species recorded	81.4	77.8
Third sample		
No. species recorded	71	71
No. species estimated	88	90
95% confidence limits	71-104	79-101
% estimated species recorded	80.7	78.9

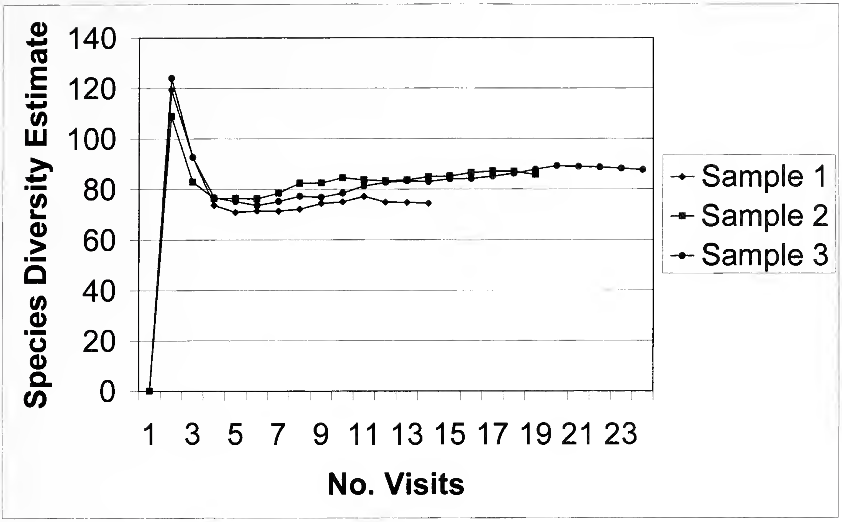

FIGURE 1.
Chao presence/absence estimates of species diversities for samples 1, 2 and 3 of Duncombe Park.

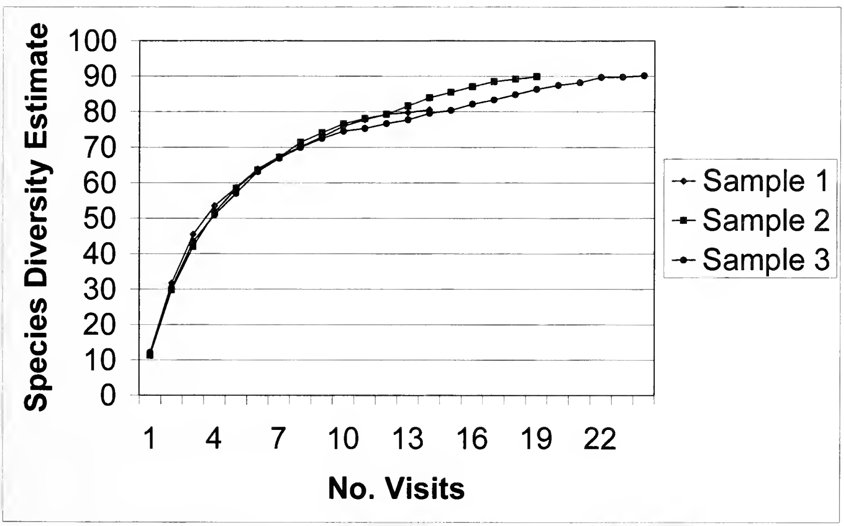

FIGURE 2.
First order Jackknife estimates of species diversities for samples 1, 2 and 3 of Duncombe Park.

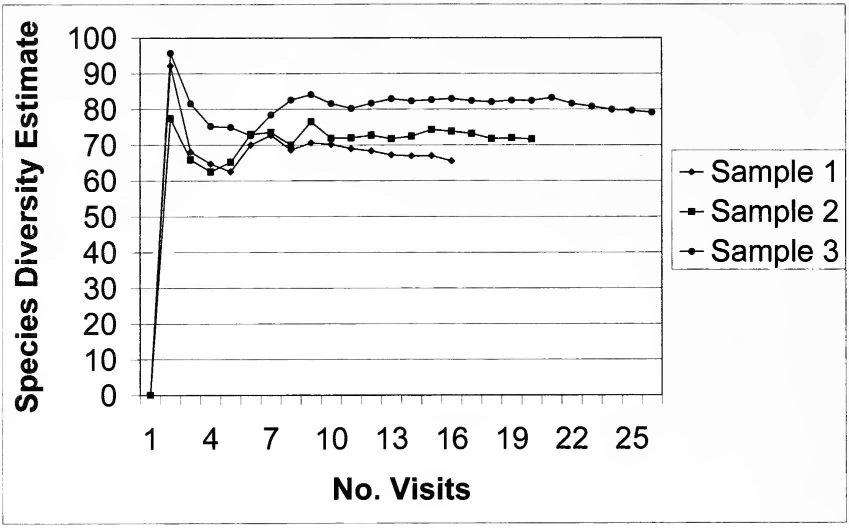

FIGURE 3.
Chao presence/absence estimates of species diversities for samples 1, 2 and 3 of Burton Leonard Lime Quarries.

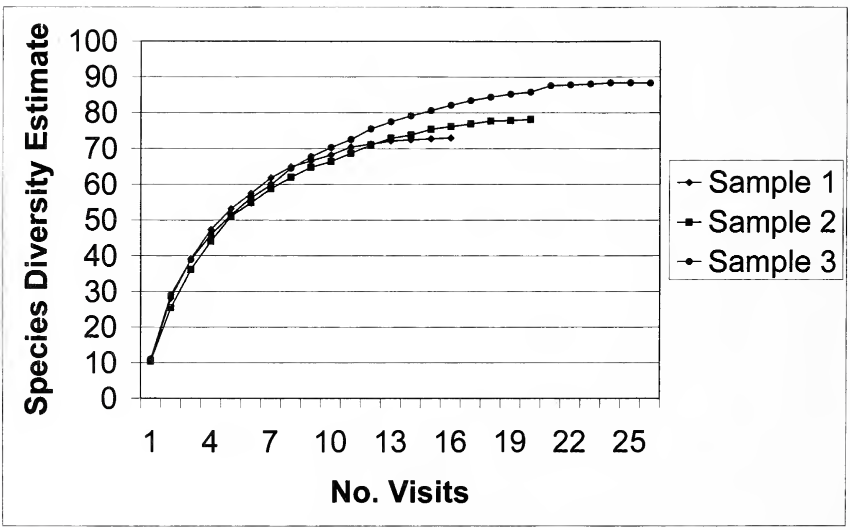

FIGURE 4.
First order Jackknife estimates of species diversities for samples 1, 2 and 3 of Burton Leonard Lime Quarries.

for both statistical procedures, and the final species diversity estimates are now more similar to each other. With this information, a decision could have been taken to cease further recording. The analyses of the third sample, which include further visits, justifies this decision since the species diversities still stabilize, and the final species diversities of the second and third samples closely agree with each other.

TABLE 3.
Non-parametric estimates of species richness at Burton Leonard Lime Quarries.

	Chao estimate	Jackknife estimate
First sample		
No. species recorded	58	58
No. species estimated	66	73
95% confidence limits	56-75	65-81
% estimated species recorded	87.9	79.5
Second sample		
No. species recorded	62	62
No. species estimated	72	78
95% confidence limits	61-82	71-85
% estimated species recorded	86.1	79.5
Third sample		
No. species recorded	71	71
No. species estimated	79	88
95% confidence limits	70-88	79-98
% estimated species recorded	89.9	80.7

The analyses of the first, second and third samples from Burton Leonard show that while the species diversity estimates stabilize, the final species diversity estimate gradually increases from the first to the third sample. In addition, the final species diversities estimates from the two statistical procedures always show too great a difference which increases, rather than decreasing, from the first to the third samples. Clearly recording should not have ceased after the first sample was obtained. Should recording continue after the third sample had been completed?

The statistical procedures have been helpful in determining when recording could cease for Duncombe Park but not for Burton Leonard. Why should this be so? A major difference between the two sites is that Duncombe Park has an area of 103ha which is nearly five times larger than Burton Leonard with an area of 22ha. Tourist species could therefore be more likely to be found at Burton Leonard. Tourist species live in the geographical area of the site under study but do not normally obtain their resources, mainly nest sites and food, from that site. From the species list for Burton Leonard, at least four could be considered tourist species: *Andrena clarkella* and *A. fucata* nest in sandy habitats which are not present at Burton Leonard; the hosts of the cleptoparasite *Nomada rufipes*, which were not recorded, also nest in sandy habitats; the nests of *Odynerus spinipes* are usually found in aggregations and no such aggregation was found. On removing these four species, analysis shows that the two species diversity estimates, besides stabilizing, also indicate the same final species diversity estimate of 68 species. Recording can now cease at Burton Leonard, although a case could be made for its continuance as a means of sampling further tourist species from the surrounding countryside.

SPECIES QUALITY

Archer (1999, 2002) developed a national quality scoring system of high and low quality species. High quality species have a scarce (≡ Nb), rare (≡ Na) or very rare (≡ RDB) status, while low quality species have a universal, widespread or restricted status. By giving an

Archer national status to each of the 71 species of solitary wasps and bees from Burton Leonard and Duncombe Park, national quality scores and national species quality scores (SQSs) can be calculated (Table 4). The two Scarce species from Burton Leonard are *Monosapyga clavicornis* (Linn.) and *Sphecodes crassus* Thomson. From Duncombe Park, the Very Rare species is *Crossocerus leucostomus* (Linn.), the Rare species is *C. walkeri* (Shuckard) and the Scarce species are *Pseudomalus violaceus* (Scopoli) and *Pemphredon morio* Van der Linden.

TABLE 4.
Archer national quality scores of solitary species recorded from Burton Leonard Lime Quarries (BL) and Duncombe Park (DP)

National status	Status value (A)	No. of species (B)		Quality scores (A x B)	
		BL	DP	BL	DP
Universal	1	43	39	43	39
Widespread	2	26	28	52	56
Scarce	8	2	2	16	16
Rare	16	0	1	0	16
Very rare	32	0	1	0	32
Total		71	71	111	159

Species Quality Score for Burton Leonard 111/71 = 1.6
and for Duncombe Park 159/71 = 2.2

Archer (1999) showed that although quality scores are influenced by the area of sites, the SQSs are relatively independent of site areas so SQSs can be used to compare sites without regard to site areas. Archer (2003), on the basis of their SQS, divided Watsonian Yorkshire sites into first class (SQS 2.4-2.9), second class (SQS 1.8-2.3) and third class (SQS 1.2-1.7) sites. Burton Leonard is a third class site and Duncombe Park a second class site, just failing from becoming a first class site. Few Watsonian Yorkshire sites are first class sites. Currently the first class sites are Strensall Common, Crow Wood and Pollington Common and previously Spurn Point and Allerthorpe Common before it was coniferized.

SUMMARY

1. Non-parametric statistical procedures for determining when to cease recording from a site was helpful for Duncombe Park, but not for Burton Leonard until some tourist species had been removed from the analysis.
2. Within a Watsonian Yorkshire context based on Species Quality Scores, Burton Leonard is a third class site and Duncombe Park a second class site.
3. Two species of national importance were recorded from Burton Leonard and four species of national importance from Duncombe Park.

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FORGOTTEN HISTORICAL RECORDS OF THE SMALL BLUE BUTTERFLY, *CUPIDO MINIMUS*, IN YORKSHIRE, AND THEIR RELEVANCE TO SOME BIOLOGICAL CONUNDRUMS

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In *The Butterflies of Yorkshire* (2005), the Small, or Little, Blue, *Cupido minimus* (Fuessly) is listed as "Former resident now probably extinct". An historical review given there by Howard Frost reports that, as recorded by Porritt (1883), the earliest find, published in 1842, was from a site about 10 miles from York, subsequent to which there were scattered records from central and southern parts of the county and others from the Yorkshire Wolds and the Scarborough and Pickering areas, with an outlier at Buckden in Wharfedale. Buckden was the last place at which, in 1908, it is known to have occurred in Yorkshire. The statement by Ford (1945) that "it exists in Yorkshire" is unsubstantiated. Frost, however, provided information which suggests that there may have been a colony near Sedbergh as recently as 1949. Apart from this, one of the most recent records was from the Wetherby area, reported in Porritt (1904) who cites B.B.Thompson as his authority. It is therefore appropriate to draw attention to what appear to be other overlooked records of its occurrence and former status in that area, not least because they also provide information on controversial aspects of its ecology and behaviour.

A brief note by Lees (1901a) refers to the presence of the Small Blue in the vicinity of Wetherby and gives information on its life history. As this is brief, concise and informative, it is reproduced in full: "The best insect regularly occurring in the district is the Little Blue Buttterfly (*Chrysophanus minimus*), always common on the rough banks of road and rail about Wetherby and Collingham. It flies in late May, but the pinky larvae will now be found *in the flower heads* of the Lady's Finger Vetch, where they persist unchanging till the pupation-time of Spring's first sunny days. *Anthyllis* is common and a few hundred heads can be carried home for examination at leisure".

The writer of the note was F. Arnold Lees, better known as a botanist and the author of *The Flora of West Yorkshire* (1888) and, with J. W. Davis, of *West Yorkshire: An Account of its Geology, Physical Geography, Climatology and Botany* (1878), of whose work an account is given by Seaward in the introduction to a reprint of the *Flora* in 1978. The Vetch concerned, *Anthyllis vulneraria*, is now referred to as the Kidney Vetch.

As Lees, who resided for some time in the Wetherby area and paid particular attention to its flora between 1879 and 1881, refers to the Small Blue as "regularly occurring" and "always common" there, it is reasonable to assume that this status still prevailed in 1901. That this was indeed the case is made clear in an account that is even less likely to be read than his note, but in which he gives further valuable information on its status at that time and place. He did so in the report of a Yorkshire Naturalists' Union excursion in the Wetherby area (Lees 1901b). This was held in July 1901, too late to expect to find adults of

the Small Blue, but Lees records that some participants collected withered flower heads of *Anthyllis vulneraria* "off the railway banks where the Little Blue abounds in early June" in order to obtain the subsequently emerging adults. As in his earlier note, he states precisely that "the pinky larva embeds itself cosily among the 'flocks' of the capitulum, and hibernates there, pupating in April, early or late according as her calenture is pronounced or deferred". [The meaning of calenture in this context is obscure! The ending of diapause is probably implied.] He also says that it flies over the "grassy slopes and banks which, above a yard or two, it never leaves", and goes on to say that "Its small size and weak wing power make it extremely 'local'. Up to 1881 it used to abound in a dozen or more places on the rail-line side, a hundred yards or so west of Wetherby station, and at intervals in the 'bays' of the cuttings, for a mile Linton way and Spofforth way; in Kirk Deighton quarry likewise, in thousands". The year 1881 marks the end of the period during which he devoted particular attention to the Wetherby area. The rail lines in question have long been closed, but the topographic changes to the environment brought about by their construction remain.

Several points in this report are of interest. That the Small Blue flourished on railway embankments and in cuttings is particularly significant as Ford (1945), Heath *et al.* (1984) and Frost (2005) have drawn attention to the suitability of these habitats for this species – an aspect of whose ecology with which Lees was clearly already familiar. That the Small Blue used to "abound" in a dozen or more such places beside the railway lines in the Wetherby area, and that it occurred "in thousands" in Kirk Deighton quarry stands in marked contrast to the situation in most parts of Britain today. Most surviving populations in this country are small, and even in Dorset, a stronghold of the species, it experienced a decline during the last 20 years or so of the 20th century (Thomas *et al.* 1998). That it was so abundant in the Wetherby area causes one to wonder whether it persisted there longer than Yorkshire records suggest. If it died out there by 1908 its decline must have been rapid over an extensive area. Whenever this happened, a major problem for the naturalist is how to explain what caused such wholesale extinction.

Observations recorded in these old accounts also reveal how imperfect is our understanding of the habits and behaviour of what in some places is a relatively common species. Various works state that the sole food plant of the larvae is *Anthyllis vulneraria,* but Asher *et al.* (2001) note that in Britain the Small Blue has bred on large-flowered continental varieties of this plant – presumably *A. v. polyphylla* – that have been deliberately sown on road verges. More striking is that Lanfranchis (2000) records the use of no fewer than eight other species of the Fabiaceae by larvae in certain areas of France, though *A. vulneraria* is the main food plant there.

More problematic are differences in pupation habits reported by different authors. Lees (1901b) clearly stated that the larvae remain on the flower heads throughout the winter and pupate there in the following spring. That this is so is demonstrated by the fact that, after they have ceased to feed, larvae can still be found among dried flower heads. Lees had evidently collected dormant larvae in this way, and participants in the excursion to Wetherby collected old flower heads on which to search for such larvae later. Frohawk (1924, 1934), who had reared every species of British butterfly, concurs with Lees and states categorically (1934) that when full grown in late July, the larva "prepares for pupation by spinning a few strands of silk among the flowers of *Anthyllis vulneraria*, usually binding a few of the calyces together and resting between them; it then enters into complete torpidity and remains motionless until the beginning of the following May, when it pupates". He also gives an illustration of a larva ensconced within a flower head which is unambiguously labelled 'Larva hibernating'. All this is in perfect agreement with Lees (1901b). Ford (1945) also says that the larva "covers itself with a few threads spun on its food plant", and Carter (1982) that it "over-winters in the calyx of a dead flower" and that pupation takes place in the following year.

Asher *et al.* (2001), however, say that when the larvae are fully grown they descend to the ground and pass the winter in soil crevices or under moss, as does Thomas (1986); Heath *et al.* (1984) say that full fed larvae leave the seed heads and pupate on the ground.

Thomas and Webb (1984), in an excellent account of the butterflies of Dorset, say "the pupa is formed on the ground" and Steel and Steel (1985) reporting on the butterflies of Berkshire, Buckinghamshire, and Oxfordshire say that, when mature, larvae leave the seed heads and hibernate on the ground. South (new edition 1941) is non-commital. Emmet and Heath (1989) are tantalisingly ambiguous; they say that full grown larvae are seldom encountered after the beginning of August, when they enter diapause, from which they emerge in the following year and pupate without further feeding, but do not say where this period is spent. They do, however, say that the pupa is usually positioned head up, attached by the cremister to a silk pad with a silk girdle, and that pupation takes place on a moss stem, a blade of grass, or under a leaf – which is not entirely in agreement with either of the other two described sequences, though they give no hint that it buries itself in ground debris. In his much older work, Newman (1870-71), who had never seen either the larva or pupa of this species, cites the observations of yet older naturalists and says that the pupa is "attached by a belt to a stalk *of the food plant*" (my emphasis), which agrees more with what Lees reported than with accounts of pupation taking place in ground debris.

Minor deviations apart, we have two contradictory accounts of where the hibernating larvae over-winter; those of Lees and Frohawk are the more convincing. Lees had clearly seen what he described, and Frohawk had reared the insect from egg to adult. One cannot, however, reject out of hand the statements of those who claim that the larvae hibernate on, or buried in debris on, the ground. Is it possible that there are two races, or even two cryptic species of the Small Blue in Britain, whose larvae differ in habits? Or is larval behaviour influenced by factors of which we are as yet ignorant? One has also to bear in mind that some accounts may be derivative and not based on personal observations. This does not apply to those of Lees and Frohawk. Ironically, as I discovered only after unearthing all the above references to the matter, the pupation site of the Small Blue has long been a source of disagreement. In his account of this species, with whose pupa he was himself unacquainted, Kirby (1896) says that "it is found on the ground, unattached, according to some writers, but others say that it is attached by a belt to a stalk of the food plant"!

Colony size varies much, and there is considerable disparity in accounts of flight behaviour. According to Thomas (1986) most British colonies consist of a few tens of adults, which fly and breed in the same few square yards of ground year after year, and Emmet and Heath (1989) say that both sexes are highly sedentary and spend most of their time basking or resting. They say that flights are typically short, but partly contradict this by reporting that the perching areas of males may be hundreds of metres from patches of Kidney Vetch, and that roosting sites, where nights are spent, may be hundreds of metres from perching and feeding sites. On the other hand, Asher *et al.* (2001) report that mark and recapture studies have shown that adults seldom move more than 40 metres, but that movements of over a kilometre have been recorded. They agree with Thomas that some colonies are very small, often consisting of <10 adults at peak. Emmet and Heath report a colony of >1000 adults in 1982, but say that most contain <30. Heath *et al.* (1984) also report that most colonies contain fewer than 100 adults, but a few sites extend over several hectares and must support thousands of adults. The report of Lees (1901b) that the Small Blue used to "abound" along the railway on both the Linton and Spofforth sides of Wetherby and flew "in thousands" in Kirk Deighton Quarry suggests that these were among the largest colonies in the country.

Adult Small Blues are certainly gregarious in some situations. In sub-Alpine regions of France I have seen aggregations of up to >50 individuals (counted from photographs), as well as smaller assemblages, on small patches of bare, wet ground (possibly enriched by mammalian excreta in some cases) where they congregate to imbibe moisture. Aggregating individuals often settle, usually with the wings spread, very close to, and sometimes touch, their neighbours, so that all or most of them are crowded into a very small area. In such situations they are often accompanied by other species in smaller numbers, particularly by the Dingy Skipper, *Erynnis tages*, but also by occasional individuals of the Chequered

Skipper, *Carterocephalus palaemon*, Grizzled Skipper, *Pyrgus malvae*, and, less often, Wood White, *Leptidea sinapis*, that exploit the same wet patches. Aggregating individuals are so absorbed in their activity of imbibing moisture that they are not easily disturbed. Other 'Blues' seen similarly engaged elsewhere, but mostly with the wings closed, were also slow to react to disturbance and reluctant to leave what was obviously an attractive situation. I have no experience of the Small Blue in Britain, but such situations – wet patches of bare earth, with or without scattered small stones – may prove attractive to this species here in some habitats.

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BOOK REVIEWS

The World of Lakes: Lakes of the World by **Mary J. Burgis** and **Pat Morris**, with illustrations by **Guy Troughton.** Pp. iv + 280. Freshwater Biological Association, in association with MPM Publishing. £25.00 plus p. & p. from: FBA, The Ferry Landing, Far Sawrey, Ambleside, Cumbria LA22 0LP.

This is a revised and updated version of a book published 20 years ago. It deals with lakes in all their diversity, the settings in which they are found, the various ways in which they are formed, the properties of the water they contain, their floras and faunas, and interactions between lakes and man. The general reader is introduced to some of the world's most remarkable lakes and is particularly successful when dealing with such strange places as the Great Salt Lake of Utah, the Dead Sea, and the African Rift Valley soda lakes, where it diverts extensively into accounts of brine shrimps, flamingoes, and other remarkable creatures. Indeed, part of its charm lies in its diversions, which include things such as the ecology and role of the hippopotamus in Lake George, Uganda, the remarkable attributes of the soda lake cichlid fish *Oreochromis alcalicus*, and the habits of various birds. Even the Loch Ness monster gets a mention. The animals concerned are often illustrated. It is also good on man-made lakes, which include London's reservoirs as well as some of the huge lakes created by damming major rivers, and has helpful things to say about the use and abuse of lakes.

The book is less successful when it deals with more familiar situations, and with the components of lacustrine faunas and floras. Here it is not always reliable. It gets off to a bad start on page 4 where it makes the remarkable claim that Loch Ness contains more water than all the other British lakes and reservoirs put together. Amazingly, the wherewithal to refute this is provided on the facing page where a table of facts and figures relating to Scotland's 16 largest lochs shows quite clearly that, while Loch Ness is the largest and deepest, between them the next four most voluminous lakes alone contain more water! Such incorrect or confusing information often mars the text; for example, one looks in vain in the relevant table for the conductivities of the waters of some well known lakes, promised on page 37, and on page 57 we are told that there are about 1500 species of freshwater fishes in Africa, but on page 66 that there are "nearly 3000 or more". It is said that of about 1000 species of fishes in Lake Malawi "about 200" are cichlids, when in fact, as many papers, several books, and the aquarium trade make abundantly clear, it is the fantastic evolutionary proliferation of cichlids that has endowed this lake with such a rich fish fauna. Remarks about its supposed 800 species of non-cichlids are meaningless. There are probably fewer than 50. Contrary to what is said, midges of the genus *Chaoborus* do not bite, and it is to their transparent larvae that the name 'phantom' refers; unlike *Notonecta*, whose name proclaims the fact, species of *Corixa* are not backswimmers; the swan mussel *Anodonta*, illustrated as having a single siphon, has two, the *Artemia* of the Great Salt Lake is not *A. salina*; the amphipod genus *Macrohectopus* has only one species in Lake Baikal, the pelagic *M. branickii*; the 'waterflea' *Sida crystallina* attaches itself, not by means of a sticky secretion but by use of a sucker; the scientific name given to the rainbow trout belongs to an American salmon; there are far more zooplankton-eating cichlid fishes in Lake Malawi than stated; and it was with juveniles of *Oreochromis variabilis*, not *O. esculentus* that those of the introduced *Tilapia zillii* interacted on the nursery grounds in Lake Victoria. The index omits many of the organisms mentioned in the text.

While it is distressing to have to do so, honesty and the need to warn innocent readers demand that such shortcomings be pointed out. To have to make criticisms is particularly regrettable because, without such careless errors, and properly indexed, this would be an interesting, helpful and attractively arranged book, with pleasing illustrations. It provides a good introduction to the fascinating diversity of lakes, and what goes on in them, to some of the plants and animals that are to be found there, and to some of the problems that face them, sometimes in strange and seemingly unwelcoming habitats. GF

BIRD. The illustrated guide to the birds of Britain and Europe by **Peter Hayman** and **Rob Hume**. Pp. 540, with maps, photographs, coloured illustrations & a free iPod with images and songs of 250 British & European birds. Mitchell Beazley. 2007. £25.00 hardback.

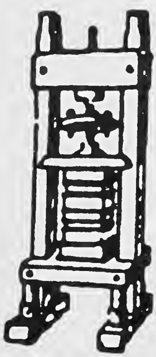
One wonders when the proliferation of bird books is going to stop and my first thoughts were 'not another'! However, I was more than pleasantly surprised by this impressive, large format book. First published as *The Complete Guide to the Birds of Britain and Europe* in 2001 by Mitchell Beazley, this reprint is unbelievable value for money.

There are the standard chapters on 'How to use the book', 'The parts of the bird', 'How to identify birds' [– no simple answer to that one!], 'The living bird', 'The families of birds', 'Bird habitats' and 'What you need to watch birds'. It is the main section, however, which raises the publication to a standard beyond mere acceptability. Every species is treated to a full page, sometimes two, with a photograph and absolutely stunning drawings by Hayman which are far superior to some of those in more academic works, showing feeding and flight postures, varying plumages and races. Most species have at least ten such images and some many more; for example, Golden Eagle has 19, Kestrel 24, Great Grey Shrike 16 and Jackdaw 24. Included in the text are details of where and when each species may be seen, with clear maps, as well as paragraphs on identification features, feeding, display and voice, breeding and migration. In short, as full and accurate account of each species as one is ever likely to see.

It is inevitable that in a work of this magnitude there will be a few points which warrant minor criticism. In the Introduction, for example, the authors say that knowledge of museum specimens often helps with field identification, which is certainly true, but also go on to say 'For most of us, a Garden Warbler is just that (if we can identify it at all). If is sings, we assume it is a male. Measurements, however, reveal differences between the sexes that can be seen if you get a good enough view and try hard enough', and that, coming after 'if we can identify it at all', is very fanciful. It is impossible to accurately sex a Garden Warbler on sight alone and such subtlety should not be introduced in a work of this kind, which will only serve to confuse beginners and lead them to believe that this is possible. The only drawings which warrant adverse comment are those of the Collared Dove, a species which does not have obvious pale edges to the upperpart feather, giving a marked scalloped effect as depicted. Although the species order follows the new BOU sequence, their recommended English names have not been used.

It is difficult not to over-enthuse about this beautifully produced book, particularly the superb drawings, but why not? This is a most informative and instructive work and anyone relatively new to the birding game should invest £25.00; even the more experienced should buy it, if only to enjoy the colour plates. I'm not sure about the minimalist main title, or the free iPod!

JRM



Printed in Great Britain by Titus Wilson & Son, Kendal ISSN 0028-0771

April-June 2008

Number 1065
Volume 133

The Naturalist

A QUARTERLY JOURNAL OF NATURAL HISTORY FOR THE NORTH OF ENGLAND

Checklist of Yorkshire Lichens – *M. R. D. Seaward*

Distribution of Red Squirrels *Sciurus vulgaris* in The Yorkshire Dales National Park, 1990-2006 – *I. R. Court and H. Fawcett*

The Wheatley Elm: A Fading Part of Yorkshire's Arboricultural Heritage? – *C. A. Howes*

Hemiptera on Sea Wormwood – *W. R. Dolling*

Published by the Yorkshire Naturalists' Union

Editor **M. R. D. Seaward** MSc, PhD, DSc, FLS, The University, Bradford BD7 1DP

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A manuscript plus disc (WORD format) OR two manuscripts, typed double-spaced on one side of the paper only with margins at top and left-hand at least 2.5cm wide, should be submitted. Latin names of genera and species, but nothing else, should be in italics. S.I. Units should be used wherever possible. Authors must ensure that their references are accurately cited, and that the titles of the journals are correctly abbreviated. Volumes of *The Naturalist* for the years 1886 to 1975 have been retrospectively numbered 11 to 100 to accord with numbering before and after this period (see YNU *Bulletin* no. 3, pp. 21-22 1985); please cite these volume numbers in all references. Table and text-figures should be prepared on separate sheets of paper. Drawings and graphs, drawn about twice the linear size they are to appear, should be in jet-black Indian ink, and legends should not be written on the figures. Photographic illustrations, normally black and white, will be considered for inclusion. **Publishable manuscripts not conforming to the above requirements will be returned for alteration.**

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The Naturalist and *Bulletin* are issued free to individual members of the Yorkshire Naturalists' Union and to Affiliated Societies.

Institutions and Subscribers £32.00 (UK), £36.00 (elsewhere) Registered Charity No. 224018

CHECKLIST OF YORKSHIRE LICHENS

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Study of the Yorkshire lichen flora has been a continuing process for three centuries, during which time the county has been fortunate in having a succession of resident and visiting enthusiasts, many of whom were able lichenologists. The county has also been unusually active in the formation of natural history societies, many of which continue to thrive to this day. Not surprisingly, this long period of activity has resulted in a substantial body of information being amassed, including manuscripts, publications and herbarium material.

Progress in Yorkshire lichenology can be interpreted in various ways, such as the cumulative number of species recorded from the county as a whole or the average number of species recorded from 10 km x 10 km grid squares. Quantitative assessment for the first hundred years is unrealistic, but the pattern of accumulation of county records over the past two centuries shows three periods of intensive activity (1) at the turn of the 19th century, (2) during the mid-19th century, and (3) from c.1960 onwards (cf. Seaward 1987, Fig.1; 1994, Fig.1). Although only 14 years have elapsed since the publication of the previous checklist (Seaward 1994), a continued high level of lichenological activity in the county (cf. Seaward 1987, Fig. 6(b); 1994, Fig. 2; 1997, Fig. 1) has resulted in a 30% increase in 10 km x 10 km grid square records and 46 new county records for lichens; this, and significant changes to lichen nomenclature and a better understanding of the status of species in the British Isles, has necessitated the publication of a revised checklist.

Fieldwork, mainly by those lichenologists mentioned in Acknowledgements below, has been supplemented by herbarium work, more particularly that by the author on the important collection at Manchester Museum (Seaward 2003). Excluding (1) monographs which have appeared in *The Lichenologist*, (2) regular lists of new and interesting lichens published in the *Bulletin of the British Lichen Society*, and (3) recent fascicles of the *Atlas of the Lichens of the British Isles* (Seaward 1995 onwards), some important sources of published Yorkshire records used in the production of this revision that are not listed in Seaward (1987, 1994) are provided below, together with a list of excluded taxa that are additional to those listed in Seaward (1994).

This latest checklist enumerates **923** taxa, **849** of which are consistently or facultatively lichenized fungi (**822** species, **5** subspecies, **17** varieties and **5** forms) and **74** are lichenicolous and non-lichenized fungi. Of the **923** taxa recorded over the past 300 years, **112** are based on old records, the great majority presumed extinct; of the **737** extant lichen taxa, **304** have been newly discovered since 1956.

The checklist, based mainly on the nomenclature of Coppins (2002) and Hawksworth (2003), identifies those taxa which are still extant in the county (**bolder type**) or have disappeared from it (lighter type), many of which are presumed extinct. The numbers after each entry refer to the number of 10 km x 10 km grid squares (maximum 195) in which the taxon occurs, followed by the number from which it has disappeared (given in parentheses); thus *Ramalina farinacea*, for example, occurs in 104 squares, has disappeared from 7 of them, and has never been recorded from 84. The level of extinction, of considerable importance to conservation studies, can therefore be determined from these figures, but for many species our knowledge is imperfect; therefore, in a few cases, as indicated by a single or double asterisk, figures have been highlighted to exemplify under- (*) and over- (**) recording through taxonomic misapplication in the past or recent taxonomic segregation demanding reinterpretation of records for which limited herbarium material exists. Species indicated as [LF] and [F] refer respectively to lichenicolous fungi and non-lichenized fungi which are traditionally studied by lichenologists but usually overlooked by mycologists, but due to insufficient distributional data, no calculations relating to their presence/absence in 10 km x 10 km grid squares have been attempted.

Abrothallus parmeliarum (Sommerf.) Arnold [LF]
A. suecicus (Kirschst.) Nordin [LF]
Acarospora cervina A.Massal. 1(0)
A. fuscata (Schrad.) Th.Fr. 185(0)
A. glaucocarpa (Ach.) Körb. 19(2)
A. impressula Th.Fr. 0(1)
A. macrospora (Hepp) A.Massal. ex Bagl. 2(4)
A. rufescens (Ach.) Kremp. 16(2)
A. sinopica (Wahlenb.) Körb. 0(2)
A. smaragdula (Wahlenb.) A.Massal. 48(10)
A. umbilicata Bagl. 21(0)
A. veronensis A.Massal. 3(3)
Acrocordia conoidea (Fr.) Körb. 26(6)
A. gemmata (Ach.) A.Massal. 6(6)
A. salweyi (Leight. ex Nyl.) A.L.Sm. 18(1)
Adelococcus alpestris (Zopf) Theiss. & Syd. [LF]
Agonimia allobata (Stizenb.) P.James 2(0)
A. gelatinosa (Ach.) M.Brand & Diederich 4(0)
A. globulifera Brand & Diederich 1(0)
A. tristicula (Nyl.) Zahlbr. 52(0)
Agyrium rufum (Pers.) Fr. [F]
Ainoa mooreana (Carroll) Lumbsch & I.Schmitt 0(1)
Alectoria nigricans (Ach.) Nyl. 1(1)
Amandinea lecideina (H.Mayrhofer & Poelt) Scheid. & H.Mayrhofer 1(0)
A. punctata (Hoffm.) Coppins & Scheid. 130(4)
Amygdalaria pelobotryon (Wahlenb.) Norman 2(1)
Anaptychia ciliaris Körb. ex A.Massal. ssp. ciliaris 10(43)
A. runcinata (With.) J.R.Laundon 2(0)
Anisomeridium biforme (Borrer) R.C.Harris 9(5)
A. polypori (Ellis & Everh.) M.E.Barr 23(0)
A. ranunculospora Coppins & P.James 8(0)
Arctoparmelia incurva (Pers.) Hale 32(1)
Arthonia apotheciorum (A.Massal.) Almq. [LF]
A. arthonioides (Ach.) A.L.Sm. 7(3)
A. cinnabarina (DC.) Wallr. 3(9)
A. didyma Körb. 4(1)
A. elegans auct.brit., non (Ach.) Almq. 3(1)
A. intexta Almq. [LF]
A. lapidicola (Taylor) Branth & Rostr. 7(0)
A. ligniaria Hellb. 2(0)
A. muscigena Th.Fr. 3(0)
A. pruinata (Pers.) Steud. ex A.L.Sm. 0(8)
A. punctiformis Ach. [LF]
A. radiata (Pers.) Ach. 34(11)
A. spadicea Leight. 3(0)
A. varians (Davies) Nyl. [LF]
A. vinosa Leight. 11(4)
Arthopyrenia analepta (Ach.) A.Massal. [F]
A. cinereopruinosa (Schaer.) A.Massal. [F]
A. fraxini A.Massal. [F]
A. nitescens (Salwey) Mudd 0(1)
A. punctiformis A.Massal. [F]
A. salicis A.Massal. 0(2)
A. saxicola A.Massal. 1(3)

Arthrorhaphis citrinella (Ach.) Poelt 4(0)
A. grisea Th.Fr. [LF]
A. muddii Obermayer [LF]
Aspicilia caesiocinerea (Nyl. ex Malbr.) Arnold 7(1)
A. calcarea (L.) Körb. 119(4)
A. cinerea (L.) Körb. [s.lat.] 11(8)
A. contorta (Hoffm.) Kremp. ssp. contorta 109(1)
ssp. hoffmanniana S.Ekman & Fröberg 3(0)*
A. grisea Arnold 1(0)
A. intermutans (Nyl.) Arnold 0(1)
A. laevata (Ach.) Arnold 2(1)
A. recedens (Taylor) Arnold 0(1)
Athelia arachnoidea (Berk.) Jülich [LF]

Bacidia adastra Sparrius & Aptroot 2(0)
B. arceutina (Ach.) Arnold 5(3)
B. arnoldiana Körb. 33(0)
B. bagliettoana (A.Massal. & de Not.) Jatta 12(7)
B. beckhausii Körb. 0(1)
B. caligans (Nyl.) A.L.Sm. 10(0)
B. chloroticula (Nyl.) A.L.Sm. 7(0)
B. circumspecta (Norrl. & Nyl.) Malme 2(0)
B. delicata (Larbal. ex Leight.) Coppins 5(0)
B. egenula (Nyl.) Arnold 3(0)
B. friesiana (Hepp) Körb. 2(0)
B. fuscoviridis (Anzi) Lettau 2(0)
B. incompta (Borrer ex Hook.) Anzi 4(6)
B. inundata (Fr.) Körb. 16(2)
B. laurocerasi (Delise ex Duby) Zahlbr. 0(11)
B. phacodes Körb. 0(2)
B. rubella (Hoffm.) A.Massal. 11(14)
B. saxenii Erichsen 8(0)
B. viridifarinosa Coppins & P.James 7(0)
Bachmanniomyces uncialicola (Zopf) D.Hawksw. [LF]
Bactrospora corticola (Fr.) Almq. 1(0)
Baeomyces placophyllus Ach. 5(0)
B. rufus (Huds.) Rebent. 97(9)
Belonia nidarosiensis (Kindt) P.M.Jørg. & Vězda 63(0)
Biatora sphaeroides (Dicks.) Körb. 6(10)
Biatoridium monasteriensis J.Lahm ex Körb. 0(1)
Bilimbia lobulata (Sommerf.) Hafellner & Coppins 11(3)
B. sabuletorum (Schreb.) Arnold 109(3)
Botryolepraria lesdanii (Hue) Canals et al. 20(0)*
Bryophagus gloeocapsa Nitschke ex Arnold 4(0)
Bryoria bicolor (Ehrh.) Brodo & D.Hawksw. 0(9)
B. capillaris (Ach.) Brodo & D.Hawksw. 0(1)
B. chalybeiformis (L.) Brodo & D.Hawksw. 2(6)
B. fuscescens (Gyeln.) Brodo & D.Hawksw. var. fuscescens 38(12)
var. positiva (Gyeln.) Brodo & D.Hawksw. 0(1)
B. subcana (Nyl.ex Stizenb.) Brodo & D.Hawksw. 2(2)
Buellia aethalea (Ach.) Th.Fr. 108(0)
B. disciformis (Fr.) Mudd 2(6)
B. erubescens Arnold 1(0)
B. griseovirens (Turner & Borrer ex Sm.) Almb. 19(0)

B. ocellata (Flot.) Körb. 6(4)
B. pulverea Coppins & P.James 7(0)
B. schaereri De Not. 3(1)
B. stellulata (Taylor) Mudd 8(1)**
B. subdisciformis (Leight.) Vainio 1(0)
Bunodophoron melanocarpum (Sw.) Wedin 5(13)

Calicium abietinum Pers. 0(4)
C. adspersum Pers. 0(1)
C. glaucellum Ach. 15(1)
C. salicinum Pers. 0(4)
C. viride Pers. 46(8)
Caloplaca arcis (Poelt & Vězda) Arup 6(0)*
C. aurantia (Pers.) Hellb. 48(8)
C. cerina (Ehrh. ex Hedw.) Th.Fr. 10(6)
var. chloroleuca (Sm.) Th.Fr. 0(2)
C. cerinella (Nyl.) Flagey 3(0)
C. chalybaea (Fr.) Müll.Arg. 9(0)
C. chlorina (Flot.) H.Olivier 98(0)
C. cirrochroa (Ach.) Th.Fr. 12(2)
C. citrina (Hoffm.) Th.Fr. [s.lat.] 194(1)
C. crenularia (With.) J.R.Laundon 49(9)
C. crenulatella (Nyl.) H.Olivier 18(1)
C. dalmatica (Massal.) H.Olivier 9(0)
C. decipiens (Arnold) Blomb. & Forssell 121(2)
C. dichroa Arup 1(0)
C. ferruginea (Huds.) Th.Fr. 0(3)
C. flavescens (Huds.) J.R.Laundon 154(1)
C. flavocitrina (Nyl.) H.Olivier 35(0)*
C. flavorubescens (Huds.) J.R.Laundon 1(5)
C. flavovirescens (Wulfen) Dalla Torre & Sarnth. 31(6)
C. herbidella (Hue) H.Magn. 1(0)
C. holocarpa (Hoffm.) A.E.Wade 174(0)
C. lactea (A.Massal.) Zahlbr. 22(1)
C. luteoalba (Turner) Th.Fr. 1(15)
C. marina (Wedd.) Zahlbr. ex Du Rietz 4(0)
C. obscurella (Lahm ex Körb.) Th.Fr. 9(0)
C. ochracea (Schaer.) Flagey 2(3)
C. phlogina (Ach.) Flagey 2(0)
C. pollinii (A.Massal.) Jatta 0(1)
C. polycarpa (A.Massal.) Zahlbr. 1(0)
C. saxicola (Hoffm.) Nordin 131(5)
C. teicholyta (Ach.) J.Steiner 68(0)
C. thallincola (Wedd.) Du Rietz 1(0)
C. ulcerosa Coppins & P.James 2(0)
C. variabilis (Pers.) Müll.Arg. 16(0)
C. verruculifera (Vain.) Zahlbr. 1(0)
Calvitimela aglaea (Sommerf.) Hafellner 2(1)
Candelaria concolor (Dicks.) Stein 2(8)
Candelariella aurella (Hoffm.) Zahlbr. f. aurella 184(1)
f. smaragdula Szatala 3(0)
C. coralliza (Nyl.) H.Magn. 7(0)
C. medians (Nyl.) A.L.Sm. f. medians 103(0)
f. steepholmensis O.L.Gilbert 1(0)

C. reflexa (Nyl.) Lettau 40(0)
C. vitellina (Hoffm.) Müll.Arg. f. vitellina 192(1)
f. flavovirella (Nyl.) A.Henderson 10(0)
C. xanthostigma (Ach.) Lettau 19(0)
Carbonea supersparsa (Nyl.) Hertel [LF]
C. vitellinaria (Nyl.) Hertel [LF]
C. vorticosa (Flörke) Hertel 1(1)
Catapyrenium cinereum (Pers.) Körb. 0(2)
C. lachneum (Ach.) R.Sant. 18(7)
C. pilosellum Breuss 1(1)
C. rufescens (Ach.) Breuss 2(1)*
C. squamulosum (Ach.) Breuss 5(0)
Catillaria chalybeia (Borrer) A.Massal. 119(2)
C. contristans (Nyl.) Zahlbr. 1(0)
C. lenticularis (Ach.) Th.Fr. 105(3)
C. scotinodes (Nyl.) Coppins 1(0)
Celothelium ischnobelum (Nyl.) M.B.Aguirre 2(0)
Cercidiospora epipolytropa (Mudd) Arnold [LF]
Cetraria aculeata (Schreb.) Fr. 51(23)
C. ericetorum Opiz 0(5)
C. islandica (L.) Ach. 8(22)
C. muricata (Ach.) Eckfeldt 34(8)
C. sepincola (Ehrh.) Ach. 1(2)
Chaenotheca brachypoda (Ach.) Tibell 2(2)
C. brunneola (Ach.) Müll.Arg. 4(3)
C. chrysocephala (Turner ex Sm.) Th.Fr. 2(3)
C. ferruginea (Turner ex Sm.) Mig. 63(1)
C. furfuracea (L.) Tibell 12(1)
C. gracilenta (Ach.) Mattsson & Middelb. 2(0)
C. hispidula (Ach.) Zahlbr. 2(3)
C. phaeocephala (Turner) Th.Fr. 0(2)
C. stemonea (Ach.) Müll.Arg. 0(4)
C. trichialis (Ach.) Th.Fr. 5(1)
Chaenothecopsis debilis (Sm.) Tibell [F]
Chrysothrix candelaris (L.) J.R.Laundon 32(4)
Cladonia arbuscula ssp. squarrosa (Wallr.) Ruoss 19(15)
C. bellidiflora (Ach.) Schaer. 5(5)
C. borealis S.Stenroos 0(1)*
C. caespiticia (Pers.) Flörke 8(2)
C. callosa Delise ex Harm. 4(0)
C. cariosa (Ach.) Spreng. 2(3)
C. cervicornis (Ach.) Flot. ssp. cervicornis 27(13)
ssp. verticillata (Hoffm.) Ahti 5(3)
C. chlorophaea (Flörke ex Sommerf.) Spreng. 134(1)
C. ciliata Stirt. 1(1)
var. tenuis (Flörke) Ahti 11(3)
C. coccifera (L.) Willd. [s.lat.] 88(11)**
C. coniocraea (Flörke) Spreng. 151(0)
C. convoluta (Lam.) Anders 0(1)
C. cornuta (L.) Hoffm. 2(2)
C. crispata var. cetrariiformis (Delise ex Duby) Vain. 18(4)
C. cyathomorpha Stirt. ex Walt.Watson 4(0)
C. digitata (L.) Hoffm. 36(11)
C. diversa Asperges 17(0)*

C. fimbriata (L.) Fr. 155(4)
C. firma (Nyl.) Nyl. 1(0)
C. floerkeana (Fr.) Flörke 73(4)
C. foliacea (Huds.) Willd. 3(9)
C. furcata (Huds.) Schrad. ssp. furcata 73(10)
ssp. subrangiformis Sandst. 8(0)
C. glauca Flörke 7(1)
C. gracilis (L.) Willd. 15(16)**
C. humilis (With.) J.R.Laundon 44(5)
C. luteoalba Wheldon & A.Wilson 29(0)
C. macilenta Hoffm. 118(8)
C. ochrochlora Flörke 17(7)
C. parasitica (Hoffm.) Hoffm. 11(2)
C. pleurota (Flörke) Schaer. 1(1)*
C. pocillum (Ach.) Grognot 63(4)
C. polydactyla (Flörke) Spreng. var. polydactyla 85(6)
var. umbricola (Tønsberg & Ahti) Coppins 1(0)
C. portentosa (Dufour) Coem. 59(3)
C. pyxidata (L.) Hoffm. 64(5)
C. ramulosa (With.) J.R.Laundon 29(2)
C. rangiformis Hoffm. 38(5)
C. rei Schaer. 1(0)
C. scabriuscula (Delise) Nyl. 5(2)
C. squamosa (Scop.) Hoffm. var. squamosa 77(8)
var. subsquamosa (Nyl. ex Leight.) Vain. 12(6)
C. strepsilis (Ach.) Grognot 2(2)
C. subcervicornis (Vain.) Kernst. 34(0)
C. subulata (L.) F.H.Wigg. 51(11)
C. sulphurina (Michx.) Fr. 3(2)
C. uncialis ssp. biuncialis (Hoffm.) M.Choisy 38(23)
C. zopfii Vain. 0(4)
Clauzadea immersa (Hoffm.) Hafellner & Bellem. 22(11)
C. metzleri (Körb.) Clauzade & Roux ex D.Hawksw. 6(1)
C. monticola (Ach.) Hafellner & Bellem. 62(6)
Cliostomum corrugatum (Ach.) Fr. 0(7)
C. griffithii (Sm.) Coppins 84(0)
Collema auriforme (With.) Coppins & J.R.Laundon 59(0)
C. bachmanianum (Fink) Degel. 1(2)
C. callopismum A. Massal. 1(0)
C. crispum (Huds.) F.H.Wigg. 95(6)
C. cristatum (L.) F.H.Wigg. var. cristatum 20(14)
var. marginale (Huds.) Degel. 0(4)*
C. fasciculare (L.) F.H.Wigg. 0(1)
C. flaccidum (Ach.) Ach. 10(6)
C. fragile Taylor 1(0)
C. fragrans (Sm.) Ach. 0(4)
C. furfuraceum (Arnold) Du Rietz 1(2)
C. fuscovirens (With.) J.R.Laundon 25(7)
C. limosum (Ach.) Ach. 4(6)
C. multipartitum Sm. 9(5)
C. nigrescens (Huds.) DC. 0(5)
C. parvum Degel. 2(0)
C. polycarpon Hoffm. 4(8)
C. subflaccidum Degel. 3(3)

C. tenax (Sw.) Ach. var. tenax 68(17)
var. ceranoides (Borrer) Degel. 39(5)
var. vulgare (Schreb.) Degel. 5(2)
C. undulatum Laurer ex Flot. 4(4)
Collemopsidium foveolatum (A.L.Sm.) F.Mohr 8(0)
C. sublitorale (Leight.) Grube & B.D.Ryan 0(2)
Cornicularia normoerica (Gunn.) Du Rietz 0(5)
Cresponea premnea (Ach.) Egea & Torrente 0(7)
Cyphelium inquinans (Sm.) Trevis. 4(6)
C. notarisii (Tul.) Blomb. & Forssell 0(1)
C. sessile (Pers.) Trevis. [LF]
Cyrtidula hippocastani (DC.) R.C.Harris [F]
C. quercus (A.Massal.) Minks. [F]
Cystocoleus ebeneus (Dillwyn) Thwaites 13(8)

Dacampia hookeri (Borrer) A.Massal. [LF]
D. rufescentis (Vouaux) D.Hawksw. [LF]
Dactylospora athallina (Mull.Arg.) Hafellner [LF]
D. parasitica (Flörke ex Spreng.) Zopf [LF]
Degelia plumbea (Lightf.) P.M.Jørg.& P.James 0(3)
Dermatocarpon intestiniforme (Körb.) Hasse 0(1)*
D. luridum (With.) J.R.Laundon 7(5)
D. miniatum (L.) W.Mann 31(8)
Dibaeis roseus (L.f.) Rambold & Hertel 15(9)
Didymellopsis pulposi (Zopf) Grube & Hafellner [LF]
Dimerella pineti (Ach.) Vězda 46(1)
Diploicia canescens (Dicks.) A.Massal. 116(9)
Diploschistes gypsaceus (Ach.) Zahlbr. 0(2)
D. muscorum (Scop.) R.Sant. 18(1)
D. scruposus (Schreb.) Norman 43(11)
Diplotomma alboatrum (Hoffm.) Flot. 114(3)
D. pharcidium (Ach.) M.Choisy 0(1)
D. venustum Körb. 6(8)
Dirina massiliensis f. sorediata (Müll.Arg.) Tehler 50(0)

Eiglera flavida (Hepp) Hafellner 5(2)
Endocarpon pusillum Hedw. 1(0)
Endococcus propinquus (Korb.) D.Hawksw. [LF]
E. regulosus Nyl. [LF]
Enterographa crassa (DC.) Fée 15(8)
E. hutchinsiae (Leight.) A.Massal. 2(2)
E. zonata (Körb.) Källsten ex Torrente & Egea 11(1)
Ephebe lanata (L.) Vain. 0(1)
Epigloea soleiformis Döbbeler 1(0)
Epilichen scabrosus (Ach.) Clem. 2(0) [LF]
Evernia prunastri (L.) Ach. 129(6)

Farnoldia jurana (Schaer.) Hertel 12(1)
Fellhanera bouteillei (Desm.) Vězda 1(0)
F. ochracea Sparrins & Aptroot 2(0)
F. subtilis (Vězda) Diederich & Sérus. 1(0)
Fellhaneropsis vezdae (Coppins & P.James) Sérus. & Coppins 19(0)
Flavoparmelia caperata (L.) Hale 29(27)
F. soredians (Nyl.) Hale 4(0)

Fuscidea cyathoides (Ach.) V.Wirth & Vězda var. cyathoides 53(3)
var. sorediata (H.Magn.) Poelt 1(0)
F. gothoburgensis (H.Magn.) V.Wirth & Vězda 1(0)
F. kochiana (Hepp) V.Wirth & Vězda 9(5)
F. lightfootii (Sm.) Coppins & P.James 7(2)
F. lygaea (Ach.) V.Wirth & Vězda 4(5)
F. praeruptorum (Du Rietz & H.Magn.) V.Wirth & Vězda 21(0)
F. recensa (Stirt.) Hertel, V.Wirth & Vězda 3(0)

Gelatinopsis ericetorum (Körb.) Rambold & Triebel [LF]
Graphina anguina auct. [= *Graphis britannica* Staiger] **4(9)**
Graphis elegans (Borrer ex Sm.) Ach. 32(11)
G. scripta (L.) Ach. 38(16)
Gyalecta flotowii Körb. 3(1)
G. foveolaris (Ach.) Schaer. 1(3)
G. geoica (Wahlenb.) Ach. 1(1)
G. jenensis (Batsch) Zahlbr. 37(11)
G. truncigena (Ach.) Hepp 6(2)
G. ulmi (Sw.) Zahlbr. 1(5)
Gyalidea lecideopsis (Massal.) Lettau ex Vězda 1(0)
Gyalideopsis anastomosans P.James & Vězda 11(0)

Haematomma ochroleucum (Neck.) J.R.Laundon var. ochroleucum 79(1)
var. porphyrium (Pers.) J.R.Laundon 73(0)
Herteliana taylorii (Salwey) P.James 0(2)
Hymenelia epulotica (Ach.) Lutzoni 5(3)
H. heteromorpha (Kremp.) Lutzoni 1(0)
H. prevostii (Duby) Kremp. 11(1)
Hyperphyscia adglutinata (Flörke) H.Mayrhofer & Poelt 5(2)
Hypocenomyce caradocensis (Leight. ex Nyl.) P.James & Gotth.Schneid. 12(6)
H. friesii (Ach.) P.James & Gotth.Schneid. 0(2)
H. scalaris (Ach.ex Lilj.) M.Choisy 99(3)
Hypogymnia physodes (L.) Nyl. 157(2)
H. tubulosa (Schaer.) Hav. 108(1)
Hypotrachyna laevigata (Sm.) Hale 1(4)
H. revoluta (Flörke) Hale 24(3)
H. sinuosa (Sm.) Hale 0(1)

Icmadophila ericetorum (L.) Zahlbr. 2(9)
Illosporium carneum Fr. [LF]
Immersaria anthroocarpa (Ach.) Rambold & Pietschm. 1(0)
Imshaugia aleurites (Ach.) S.L.F.Mey. 3(7)
Ionaspis lacustris (With.) Lutzoni 26(2)

Lasallia pustulata (L.) Mérat 0(3)
Lecanactis abietina (Ach.) Körb. 49(4)
L. dilleniana (Ach.) Körb. 2(1)
L. subabietina Coppins & P.James 1(0)
Lecania atrynoides M.Knowles 1(0)
L. baeomma (Nyl.) P.James & J.R.Laundon 2(0)
L. chlorotiza (Nyl.) P.James 2(0)
L. coeruleorubella (Mudd) M.Mayrhofer 0(1)
L. coerulescens Mudd 0(1)
L. cuprea (Massal.) Van den Boom & Coppins 5(2)

L. cyrtella (Ach.) Th.Fr. 39(0)
L. cyrtellina (Nyl.) Sandst. 6(1)
L. erysibe (Ach.) Mudd 159(0)
L. hutchinsiae (Nyl.) A.L.Sm. 6(0)
L. inundata (Hepp ex Körb.) M.Mayrhofer 2(0)
L. naegelii (Hepp) Diederich & Van den Boom 10(1)
L. nylanderiana A.Massal. 1(3)
L. subfuscula (Nyl.) S.Ekman 2(0)
L. sylvestris (Arnold) Arnold 1(0)
L. turicensis (Hepp) Müll.Arg. 22(0)
Lecanographa amylacea (Ehrh.ex Pers.) Egea & Torrente 0(1)
L. lyncea (Sm.) Fr. 1(8)
Lecanora agardhiana Ach. 0(2)
L. aitema (Ach.) Hepp 6(1)
L. albella (Pers.) Ach. 4(4)
L. albellula (Nyl.) Th.Fr. 2(1)
L. albescens (Hoffm.) Branth & Rostr. 171(3)
L. argentata (Ach.) Malme 1(0)
L. caesiosora Poelt 34(0)
L. campestris (Schaer.) Hue ssp. campestris 164(1)
ssp. dolomitica O.L.Gilbert 9(0)
L. carpinea (L.) Vain. 16(4)
L. chlarotera Nyl. 98(12)
L. compallens Herk & Aptroot 1(0)
L. conferta (Duby ex Fr.) Grognot 65(0)
L. confusa Almb. 4(0)
L. conizaeoides Nyl. ex Cromb. 195(0)
L. crenulata Hook. 101(9)
L. dispersa (Pers.) Sommerf. 194(0)
L. epanora (Ach.) Ach. 13(3)
L. epibryon (Ach.) Ach. 1(1)
L. expallens Ach. 136(2)
L. flotowiana Spreng. 2(0)*
L. gangaleoides Nyl. 26(1)
L. handelii J.Steiner 2(0)
L. helicopis (Wahlenb.) Ach. 1(1)
L. intricata (Ach.) Ach. 101(0)
L. intumescens (Rebent.) Rabenh. 0(2)
L. muralis (Schreb.) Rabenh. 181(1)
L. orosthea (Ach.) Ach. 116(0)
L. pannonica Szatala 31(0)
L. persimilis (Th.Fr.) Nyl. 5(0)*
L. polytropa (Hoffm.) Rabenh. 189(1)
L. pulicaris (Pers.) Ach. 20(3)
L. rupicola (L.) Zahlbr. var. rupicola 67(4)
var. efflorens Leuckert & Poelt 4(0)
L. saligna (Schrad.) Zahlbr. 42(8)
L. sambuci (Pers.) Nyl. 1(2)
L. soralifera (Suza) Räsänen 163(0)
L. stenotropa Nyl. 27(0)
L. subaurea Zahlbr. 9(0)
L. subcarnea (Lilj.) Ach. 1(2)
L. sulphurea (Hoffm.) Ach. 109(2)
L. symmicta (Ach.) Ach. 30(11)

L. umbrina (Ach.) A.Massal. 3(0)*
L. varia (Hoffm.) Ach. 16(8)**
L. xanthostoma Cl.Roux ex Fröberg 1(0)
L. zosterae (Ach.) Nyl. 1(0)
Lecidea commaculans Nyl. 1(0)
L. confluens (Weber) Ach. 1(6)
L. doliiformis Coppins & P.James 1(0)
L. erythrophaea Flörke 0(3)
L. fuliginosa Taylor 0(1)
L. fuscoatra (L.) Ach. 133(1)
L. hypnorum Lib. 6(1)
L. hypopta Ach. 2(0)
L. lactea Flörke ex Schaer. 1(3)
L. lapicida (Ach.) Ach. 2(8)
L. lichenicola (A.L.Sm.& Ramsb.) D.Hawksw. 1(0)
L. lithophila (Ach.) Ach. 22(15)
L. obluridata Nyl. 0(1)
L. plana (J.Lahm) Nyl. 5(7)
L. promixta Nyl. 1(0)
L. pycnocarpa (Körb.) Ohlert 1(0)
L. silacea (Ach.) Ach. 0(2)
L. turgidula Fr. 0(2)
Lecidella asema (Nyl.) Knoph & Hertel 2(2)
L. carpathica Körb. 9(0)
L. elaeochroma (Ach.) M.Choisy f. elaeochroma 50(17)
f. sorediata (Erichsen) D.Hawksw. 2(0)
L. scabra (Taylor) Hertel & Leuckert 173(0)
L. stigmatea (Ach.) Hertel & Leuckert 172(1)
Lecidoma demissum (Rutstr.) Gotth.Schneid. & Hertel 0(4)
Lemmopsis arnoldiana (Hepp) Zahlbr. 1(0)
Lempholemma botryosum (A.Massal.) Zahlbr. 5(0)
L. cladodes (Tuck.) Zahlbr. 5(0)
L. polyanthes (Bernh.) Malme 14(2)
Lepraria caesioalba (de Lesd.) J.R.Laundon 39(0)
L. diffusa (J.R.Laundon) Kukwa 1(1)
L. eburnea J.R.Laundon 2(1)
L. elobata Tønsberg 1(0)
L. incana (L.) Ach. [s.lat.] 194(0)**
L. lobificans Nyl. 37(1)*
L. membranacea (Dicks.) Vain. 6(0)*
L. nivalis J.R.Laundon 5(0)
L. rigidula (Hue) Tønsberg 1(0)
L. vouauxii (Hue) R.C.Harris 72(0)*
Leprocaulon microscopicum (Vill.) Gams ex D.Hawksw. 0(2)
Leproplaca chrysodeta (Vain. ex Räsänen) J.R.Laundon 49(0)
L. xantholyta (Nyl.) Harm. 17(3)
Leptogium biatorinum (Nyl.) Leight. 7(2)
L. gelatinosum (With.) J.R.Laundon 37(4)
L. intermedium (Arnold) Arnold 1(0)
L. lichenoides (L.) Zahlbr. 27(10)
L. massiliense Nyl. 2(0)
L. palmatum (Huds.) Mont. 0(3)
L. plicatile (Ach.) Leight. 8(2)
L. saturninum (Dicks.) Nyl. 0(1)

L. schraderi (Ach.) Nyl. 16(6)
L. tenuissimum (Dicks.) Körb. 1(7)
L. teretiusculum (Wallr.) Arnold 3(1)
L. turgidum (Ach.) Cromb. 20(7)
Leptorhaphis epidermidis (Ach.) Th.Fr. [F]
Lichenoconium erodens M.S.Christ & D.Hawksw. [LF]
L. lecanorae (Jaap) D.Hawksw. [LF]
L. xanthoriae M.S.Christ. [LF]
Lichenodiplis lecanorae (Vouaux) Dyko & D.Hawksw. [LF]
Lichenomphalia hudsoniana (H.S.Jenn.) Redhead et al. 13(7)
L. velutina (Quél.) Redhead et al. 2(0)
L. umbellifera (L.) Redhead et al. 18(6)
Lichina confinis (O.F.Müll.) C.Agardh 2(0)
L. pygmaea (Lightf.) C.Agardh 0(1)
Lithographa tesserata (DC.) Nyl. 1(2)
Lobaria amplissima (Scop.) Forssell 1(5)
L. pulmonaria (L.) Hoffm. 2(28)
L. scrobiculata (Scop.) DC. 0(9)
L. virens (With.) J.R.Laundon 0(16)
Lobothallia radiosa (Hoffm.) Hafellner 6(4)
Loxospora elatina (Ach.) A.Massal. 4(0)

Marchandiomyces corallinus (Roberge) Diederich & D.Hawksw. [LF]
Megalaria grossa (Pers. ex Nyl.) Hafellner 0(17)
M. pulverea (Borrer) Hafellner & E.Schreiner 0(1)
Megaspora verrucosa (Ach.) Hafellner & V.Wirth 4(2)
Melanelixia fuliginosa (Fr. ex Duby) O.Blanco et al. ssp. fuliginosa 126(2)
ssp. glabratula (Lamy) O.Blanco et al. 109(3)
M. subaurifera (Nyl.) O.Blanco et al. 108(1)
Melanohalea elegantula (Zahlbr.) O.Blanco et al. 13(0)
M. exasperata (De Not.) O.Blanco et al. 5(6)
M. exasperatula (Nyl.) O.Blanco et al. 29(0)
M. laciniatula (H.Olivier) O.Blanco et al. 6(0)
Merismatium discrepans (J.Lahm) Triebel [LF]
Micarea adnata Coppins 1(0)
M. bauschiana (Körb.) V.Wirth & Vězda 20(2)
M. botryoides (Nyl.) Coppins 32(0)
M. cinerea (Schaer.) Hedl. 2(0)
M. coppinsii Tønsberg 1(0)
M. denigrata (Fr.) Hedl. 69(0)
M. erratica (Körb.) Hertel, Rambold & Pietschm. 16(3)
M. leprosula (Th.Fr.) Coppins & A.Fletcher 8(1)
M. lignaria (Ach.) Hedl. 65(1)
M. lithinella (Nyl.) Hedl. 3(0)
M. lutulata (Nyl.) Coppins 2(2)
M. lynceola (Th.Fr.) Palice 2(0)
M. melaena (Nyl.) Hedl. 37(2)
M. nitschkeana (J.Lahm ex Rabenh.) Harm. 15(1)
M. peliocarpa (Anzi) Coppins & R.Sant. 13(3)
M. polycarpella (Erichsen) Coppins & Palice 2(0)
M. prasina Fr. [s.lat.] 65(3)
M. pseudomarginata Coppins 3(0)
M. pycnidiophora Coppins & P.James 3(0)
M. sylvicola (Flot.) Vězda & V.Wirth 8(2)

M. ternaria (Nyl.) Vězda 1(0)
M. tuberculata (Sommerf.) R.A.Anderson 1(0)
Microcalicium arenarium (Hampe ex A.Massal.) Tibell [LF]
Miriquidica leucophaea (Rabenh.) Hertel & Rambold 22(4)
Moelleropsis nebulosa (Hoffm.) Gyeln. 1(1)
Muellerella hospitans Stizenb. [LF]
M. lichenicola (Sommerf.) D.Hawksw. [LF]
M. pygmaea (Körb.) D.Hawksw. var. pygmaea [LF]
var. athallina (Müll.Arg.) Triebel [LF]
M. ventosicola (Mudd) D.Hawksw. [LF]
Mycoblastus alpinus (Fr.) Kernst. 1(0)
M. caesius (Coppins & P.James) Tønsberg 4(0)
M. fucatus (Stirt.) Zahlbr. 40(0)
M. sanguinarius (L.) Norman 45(13)
Mycoporum antecellans (Nyl.) R.C.Harris [F]
Myriospora heppii Nägeli 15(3)

Nephroma laevigatum Ach. 0(7)
Nesolechia oxyspora (Tul.) A.Massal. [LF]
Normandina pulchella (Borrer) Nyl. 5(5)

Ochrolechia androgyna (Hoffm.) Arnold 98(0)
O. frigida (Sw.) Lynge 9(4)
O. microstictoides Räsänen **2(0)***
O. parella (L.) A.Massal. 104(13)
O. subviridis (Høeg) Erichsen 35(1)
O. tartarea (L.) A.Massal. 5(25)
O. turneri (Sm.) Hasselrot [s.lat.] 46(5)**
Opegrapha atra Pers. 24(8)
O. calcarea Turner ex Sm. 78(7)
O. dolomitica (Arnold) Clauzade & Cl.Roux 8(17)**
O. gyrocarpa Flot. 36(0)
O. herbarum Mont. 14(7)
O. mougeotii A.Massal. 2(2)
O. multipuncta Coppins & P.James 1(0)
O. niveoatra (Borrer) J.R.Laundon 13(6)
O. ochrocheila Nyl. 15(0)
O. rufescens Pers. 2(9)
O. rupestris Pers. [LF]
O. saxigena Taylor 0(2)
O. varia Pers. 18(12)
O. vermicellifera (Kunze) J.R.Laundon 18(2)
O. viridis (Ach.)Nyl. 0(3)
O. vulgata (Ach.) Ach. 30(15)
Ophioparma ventosa (L.) Norman 31(9)
Orphniospora moriopsis (A.Massal.) D.Hawksw. 0(4)

Pachyphiale carneola (Ach.) Arnold 0(5)
Pannaria rubiginosa (Ach.) Bory 0(3)
Parmelia discordans Nyl. 18(0)
P. omphalodes (L.) Ach. 45(17)
P. saxatilis (L.) Ach. 157(5)
P. sulcata Taylor 164(0)
Parmeliella triptophylla (Ach.) Müll.Arg. 0(1)

Parmelina pastillifera (Harm.) Hale 7(5)
P. tiliacea (Hoffm.) Hale 22(10)
Parmeliopsis ambigua (Wulfen) Nyl. 86(1)
P. hyperopta (Ach.) Arnold 2(1)
Parmotrema crinitum (Ach.) M.Choisy 0(1)
P. perlatum (Huds.) M.Choisy 18(20)
Peltigera britannica (Gyeln.) Holt.-Hartw. & Tønsberg 0(2)
P. canina (L.) Willd. 2(0)
P. didactyla (With.) J.R.Laundon 29(6)
P. horizontalis (Huds.) Baumg. 18(13)
P. hymenina (Ach.) Delise ex Duby 40(2)*
P. leucophlebia (Nyl.) Gyeln. 3(3)
P. membranacea (Ach.) Nyl. 27(2)*
P. neckeri Hepp ex Müll.Arg. 1(1)
P. polydactylon (Neck.) Hoffm. 1(0)
P. praetextata (Flörke ex Sommerf.) Zopf 36(9)
P. rufescens (Weiss) Humb. 49(15)
P. venosa (L.) Hoffm. 0(2)
Pertusaria albescens (Huds.) M.Choisy & Werner var. albescens 38(8)
    var. corallina (Zahlbr.) J.R.Laundon 65(3)
P. amara (Ach.) Nyl. 89(8)
P. aspergilla (Ach.) J.R.Laundon 27(3)**
P. coccodes (Ach.) Nyl. 26(1)
P. corallina (L.) Arnold 59(5)
P. flavicans Lamy 1(0)
P. flavida (DC.) J.R.Laundon 7(2)
P. hemisphaerica (Flörke) Erichsen 21(0)
P. hymenea (Ach.) Schaer. 30(10)
P. lactea (L.) Arnold 15(6)
P. lactescens Mudd 2(1)
P. leioplaca DC. 24(7)
P. multipuncta (Turner) Nyl. 8(4)
P. pertusa (Weigel) Tuck. 72(12)
P. pseudocorallina (Lilj.) Arnold 21(4)
P. pupillaris (Nyl.) Th.Fr. 8(0)
Peterjamesia circumscripta (Taylor) D.Hawksw. 0(1)
Petractis clausa (Hoffm.) Kremp. 16(2)
Phaeographis smithii (Leight.) de Lesd. 0(2)
Phaeophyscia nigricans (Flörke) Moberg 76(0)
P. orbicularis (Neck.) Moberg 184(0)
P. sciastra (Ach.) Moberg 0(1)
Phaeospora parasitica (Lonnr.) Zopf [LF]
P. rimosicola (Leight. ex Mudd) Hepp [LF]
Phlyctis agelaea (Ach.) Flot. 0(3)
P. argena (Spreng.) Flot. 110(0)
Physcia adscendens (Fr.) H.Olivier 173(1)
P. aipolia (Ehrh. ex Humb.) Fürnr. 17(17)
P. caesia (Hoffm.) Fürnr. 189(0)
P. clementei (Sm.) Maas Geest. 0(1)
P. dubia (Hoffm.) Lettau 78(0)
P. leptalea (Ach.) DC. 1(2)
P. tenella (Scop.) DC. 160(4)
P. tribacia (Ach.) Nyl. 5(3)
Physconia distorta (With.) J.R.Laundon 14(23)

P. enteroxantha (Nyl.) Poelt 17(1)
P. grisea (Lam.) Poelt 119(2)
P. perisidiosa (Erichsen) Moberg 13(0)
Pilophorus strumaticus Nyl. ex Cromb. 1(0)
Placopsis gelida (L.) Linds. [probably *P. lambii* Hertel & V.Wirth] **4(6)**
Placynthiella dasaea (Stirt.) Tønsberg 11(0)
P. icmalea (Ach.) Coppins & P.James 114(0)
P. oligotropha (J.R.Laundon) Coppins & P.James 4(1)
P. uliginosa (Schrad.) Coppins & P.James 113(1)
Placynthium garovaglii (A.Massal.) Malme 4(0)
P. nigrum (Huds.) Gray 65(5)
P. subradiatum (Nyl.) Arnold 4(0)
P. tantaleum (Hepp) Hue 4(0)
Platismatia glauca (L.) W.L.Culb. & C.F.Culb. 102(9)
Pleopsidium chlorophanum (Wahlenb.) Zopf 1(0)
Pleurosticta acetabulum (Neck.) Elix & Lumbsch 5(9)
Poeltinula cerebrina (DC.) Hafellner 3(2)
Polyblastia albida Arnold 11(2)
P. cruenta (Körb.) P.James & Swinscow 1(0)
P. cupularis A.Massal. 4(4)
P. deminuta Arnold 10(2)
P. dermatodes A.Massal. 6(0)
P. melaspora (Taylor) Zahlbr. 1(0)
P. wheldonii Travis 1(0)
Polychidium muscicola (Sw.) Gray 0(3)
Polycoccum marmoratum (Kremp.) D.Hawksw. [LF]
P. peltigerae (Fuckel) Vĕzda [LF]
P. squamarioides (Mudd) Arnold [LF]
Polysporina lapponica (Schaer.) Degel. 4(0)
P. simplex (Davies) Vĕzda 61(0)
Porina aenea (Wallr.) Zahlbr. 32(5)
P. borreri (Trevis.) D.Hawksw. & P.James 1(5)
P. chlorotica (Ach.) Müll.Arg. 35(4)
P. guentheri (Flot.) Zahlbr. var. guentheri 1(0)
P. lectissima (Fr.) Zahlbr. 5(0)
P. leptalea (Durieu & Mont.) A.L.Sm. 2(0)
P. linearis (Leight.) Zahlbr. 19(1)
Porpidia cinereoatra (Ach.) Hertel & Knoph 22(2)*
P. crustulata (Ach.) Hertel & Knoph. 84(6)
P. hydrophila (Fr.) Hertel & A.J.Schwab 3(9)
P. macrocarpa (DC.) Hertel & A.J.Schwab 99(5)
P. melinodes (Körb.) Gowan & Ahti 1(0)
P. platycarpoides (Bagl.) Hertel 7(3)
P. rugosa (Taylor) Coppins & Fryday 5(0)
P. soredizodes (Lamy ex Nyl.) J.R.Laundon 108(0)
P. speirea (Ach.) Kremp. 4(4)
P. tuberculosa (Sm.) Hertel & Knoph 181(0)
Pronectria robergei (Mont. & Desm.) Lowen [LF]
Protoblastenia calva (Dicks.) Zahlbr. 19(3)
P. cyclospora (Hepp ex Körb.) Poelt 1(1)
P. incrustans (DC.) J.Steiner 12(0)
P. rupestris (Scop.) J.Steiner 118(1)
Protopannaria pezizoides (Weber) P.M.Jørg. & S.Ekman 3(7)
Protoparmelia atriseda (Fr.) R.Sant.& V.Wirth 0(2)

P. badia (Hoffm.) Hafellner 86(3)
P. memnonia Hafellner & Türk 1(0)
Pseudephebe pubescens (L.) M.Choisy 2(7)
Pseudevernia furfuracea (L.) Zopf [s.lat.] 98(9)
var. ceratea (Ach.) D.Hawksw. 74(6)
Psilolechia leprosa Coppins & Purvis 99(0)
P. lucida (Ach.) M.Choisy 178(0)
Psora decipiens (Hedw.) Hoffm. 0(1)
P. lurida (Ach.) DC. 14(5)
Psoroglaena stigonemoides (Orange) Henssen 1(0)
Psoroma hypnorum (Vahl) Gray 0(3)
Psorotichia schaereri (A.Massal.) Arnold 2(1)
Pterygiopsis concordatula (Nyl.) Henssen & P.M.Jørg. 4(0)
P. lacustris P.M.Jørg.& R.Sant. 1(0)
Punctelia subrudecta (Nyl.) Krog [s.lat.] 50(3)**
P. jeckeri (Roum.) Kalb 3(0)*
Pycnothelia papillaria Dufour 1(9)
Pyrenocollema arenisedum (A.L.Sm.) Coppins 1(0)
P. caesium (Nyl.) R.C.Harris 1(0)
P. monense (Wheldon) Coppins 5(0)
Pyrenula chlorospila Arnold 2(2)
P. macrospora (Degel.) Coppins & P.James 1(2)
P. nitidella (Flörke ex Schaer.) Müll.Arg. 0(1)
Pyrrhospora quernea (Dicks.) Körb. 48(6)

Racodium rupestre Pers. 17(11)
Ramalina calicaris (L.) Fr. 0(7)
R. canariensis J.Steiner 2(2)
R. capitata (Ach.) Nyl. 3(0)
R. cuspidata (Ach.) Nyl. 0(2)
R. farinacea (L.) Ach. 105(7)
R. fastigiata (Pers.) Ach. 6(13)
R. fraxinea (L.) Ach. 5(30)
R. lacera (With.) J.R.Laundon 0(2)
R. siliquosa (Huds.) A.L.Sm. 14(5)
R. subfarinacea (Nyl. ex Cromb.) Nyl. 4(4)
Ramonia interjecta Coppins 2(0)
Rhizocarpon distinctum Th.Fr. 27(0)
R. geographicum (L.) DC. 83(2)
R. lavatum (Fr.) Hazsl. 14(2)
R. lecanorinum Anders 1(0)
R. oederi (Weber) Körb. 31(2)
R. petraeum (Wulfen) A.Massal. 46(11)
R. reductum Th.Fr. 156(0)
R. richardii (Nyl.) Zahlbr. 0(7)
R. umbilicatum (Ramond) Flagey 21(7)
R. viridiatrum (Wulfen) Körb. 0(8)
Rimularia badioatra (Kremp.) Hertel & Rambold 2(0)
R. furvella (Nyl. ex Mudd) Hertel & Rambold 5(0)
R. insularis (Nyl.) Hertel & Rambold 0(2)
R. intercedens (H.Magn.) Coppins 1(0)
Rinodina atrocinerea (Hook.) Körb. 1(2)
R. bischoffii (Hepp) A.Massal. 9(0)
R. efflorescens Malme 1(0)

R. gennarii Bagl. 170(0)
R. immersa (Körb.) Zahlbr. 1(0)
R. oleae Bagl. 20(4)
R. oxydata (A.Massal.) A.Massal. 1(0)
R. pityrea Ropin & H.Mayrhofer 4(0)
R. roboris (Dufour ex Nyl.) Arnold 0(4)
R. sophodes (Ach.) A.Massal. 0(3)
R. teichophila (Nyl.) Arnold 95(1)
Ropalospora viridis (Tønsberg) Tønsberg 2(0)
Roselliniopsis gelidaria (Mudd) Matzer [LF]

Sagiolechia protuberans (Ach.) A.Massal. 1(0)
Sarcogyne privigna (Ach.) A.Massal. 6(2)
S. regularis Körb. 116(1)
Sarcopyrenia gibba (Nyl.) Nyl. var. geisleri (Beckh.) Nav.-Ros. & Hladun [LF]
Sarcosagium campestre (Fr.) Poetsch & Schied. var. campestre 6(0)
var. macrosporum Coppins & P.James 1(0)
Schaereria cinereorufa (Schaer.) Th.Fr. 13(3)
S. fuscocinerea (Nyl.) Clauzade & Cl.Roux var. fuscocinerea 2(0)
Schismatomma cretaceum (Hue) J.R.Laundon 1(0)
S. decolorans (Turner & Borrer ex Sm.) Clauzade & Vězda 21(0)
Sclerococcum sphaerale (Ach.) Fr. [LF]
Sclerophora pallida (Pers.) Y.J.Yao & Spooner 0(3)
S. peronella (Ach.) Tibell 0(1)
Scoliciosporum chlorococcum (Graewe ex Stenh.) Vězda 79(0)
S. pruinosum (P.James) Vězda 2(0)
S. umbrinum (Ach.) Arnold 152(3)
Skyttea buelliae Sherwood, D.Hawksw. & Coppins [LF]
S. elachistophora (Nyl.) Sherwood & D.Hawksw. [LF]
S. gregaria Sherwood, D.Hawksw. & Coppins [LF]
Solenopsora candicans (Dicks.) J.Steiner 37(4)
S. vulturiensis A.Massal. 1(0)
Solorina saccata (L.) Ach. 22(15)
S. spongiosa (Ach.) Anzi 5(8)
Sphaerophorus fragilis (L.) Pers. 13(11)
S. globosus (Huds.) Vain. 19(24)
Sphinctrina turbinata (Pers.) De Not. [LF]
Sporodictyon schaererianum A.Massal. 1(0)
Squamarina cartilaginea (With.) P.James 18(6)
Staurothele bacilligera (Arnold) Arnold 1(0)
S. caesia (Arnold) Arnold 3(0)
S. fissa (Taylor) Zwackh 5(2)
S. guestphalica (Lahm ex Körb.) Arnold 4(0)
S. hymenogonia (Nyl.) Th.Fr. 5(5)
S. rugulosa (A.Massal.) Arnold 1(0)
S. rupifraga (A.Massal.) Arnold 9(3)
S. succedens (Rehm ex Arnold) Arnold 2(0)
Steinia geophana (Nyl.) Stein 3(0)
Stenocybe pullatula (Ach.) Stein [F]
S. septata (Leight.) A.Massal. [F]
Stereocaulon condensatum Hoffm. 0(6)
S. dactylophyllum Flörke 10(7)
S. evolutum Graewe 11(6)
S. nanodes Tuck. 4(0)

S. pileatum Ach. 28(0)
S. vesuvianum Pers. 39(6)
var. nodulosum (Wallr.) I.M.Lamb 0(5)
var. symphycheileoides I.M.Lamb 2(0)
Sticta fuliginosa (Hoffm.) Ach. 0(5)
S. limbata (Sm.) Ach. 0(6)
S. sylvatica (Huds.) Ach. 0(7)
Stigmidium congestum (Körb.) Triebel [LF]
S. microspilum (Körb.) D.Hawksw. [LF]
Strangospora moriformis (Ach.) Stein 5(1)
S. pinicola (A.Massal.) Körb. 12(0)
Synalissa symphorea (Ach.) Nyl. 2(4)

Teloschistes flavicans (Sw.) Norman 0(1)
Tephromela atra (Huds.) Hafellner ex Kalb 135(8)
var. torulosa (Flot.) Hafellner 0(1)
T. grumosa (Pers.) Hafellner & Cl.Roux 13(0)
Thelenella muscorum (Fr.) Vain. 2(0)
Thelidium decipiens (Nyl.) Kremp. 38(2)
T. fontigenum A.Massal. 4(0)
T. impressum (Stizenb.) Zschacke 2(0)
T. incavatum Mudd 40(5)
T. minutulum Körb. 26(2)
T. papulare (Fr.) Arnold 7(1)
T. pluvium Orange 1(0)
T. pyrenophorum (Ach.) Mudd 2(4)
T. zwackhii (Hepp) A.Massal. 10(1)
Thelocarpon epibolum Nyl. [LF]
T. intermediellum Nyl. 1(0)
T. laureri (Flot.) Nyl. 6(0)
T. lichenicola (Fuckel) Poelt & Hafellner [LF]
Thelomma ocellatum (Körb.) Tibell 1(0)
Thelotrema lepadinum (Ach.) Ach. 38(13)
Thrombium epigaeum (Pers.) Wallr. 0(1)
Tomasellia gelatinosa (Chevall.) Zahlbr. [F]
Toninia aromatica (Sm.) A.Massal. 103(7)
T. sedifolia (Scop.) Timdal 17(8)
T. verrucarioides (Nyl.) Timdal 3(5)
Trapelia coarctata (Sm.) M.Choisy 159(5)
T. corticola Coppins & P.James 1(0)
T. glebulosa (Sm.) J.R.Laundon 127(2)
T. obtegens (Th.Fr.) Hertel 60(0)
T. placodioides Coppins & P.James 151(0)
Trapeliopsis flexuosa (Fr.) Coppins & P.James 60(1)
T. gelatinosa (Flörke) Coppins & P.James 6(1)
T. glaucolepidea (Nyl.) Gotth.Schneid. 3(0)
T. granulosa (Hoffm.) Lumbsch 149(2)
T. percrenata (Nyl.) Gotth.Schneid. 3(0)
T. pseudogranulosa Coppins & P.James 27(0)
T. viridescens (Schrad.) Coppins & P.James 0(2)
Tremella lichenicola Diederich [LF]
Tremolecia atrata (Ach.) Hertel 10(3)
Trichonectria hirta (A.Bloxam) Petch [LF]
Tuckermanopsis chlorophylla (Willd.) Hale 74(2)

Tylothallia biformigera (Leight.) P.James & H.Kilias 1(0)

Umbilicaria cylindrica (L.) Delise ex Duby 2(1)
U. deusta (L.) Baumg. 9(1)
U. hyperborea (Ach.) Hoffm. 0(1)
U. polyphylla (L.) Baumg. 28(18)
U. polyrrhiza (L.) Fr. 5(12)
U. proboscidea (L.) Schrad. 1(5)
U. torrefacta (Lightf.) Schrad. 7(7)
Unguiculariopsis lesdainii (Vouaux) Etayo & Diederich [LF]
Usnea articulata (L.) Hoffm. 0(3)
U. ceratina Ach. 0(1)
U. cornuta Körb. 2(0)
U. filipendula Stirt. 3(2)
U. flammea Stirt. 0(1)
U. florida (L.) F.H.Wigg. 0(10)
U. hirta (L.) F.H.Wigg. 0(2)
U. subfloridana Stirt. 71(5)

Verrucaria aethiobola Wahlenb. 17(7)
V. aquatilis Mudd 14(6)
V. baldensis A.Massal. 103(1)
V. bryoctona (Th.Fr.) Orange 4(0)
V. caerulea DC. 9(7)
V. calciseda DC. 1(5)**
V. canella Nyl. 0(1)
V. cyanea Massal. 0(3)
V. ditmarsica Erichsen 2(0)
V. dolosa Hepp 11(6)
V. dufourii DC. 12(7)
V. elaeina Borrer 3(0)
V. elaeomelaena (A.Massal.) Arnold 8(1)
V. funckii (Spreng.) Zahlbr. 1(0)
V. fuscella (Turner) Winch 75(4)
V. halizoa Leight. 1(1)
V. hochstetteri Fr. 101(2)
V. hydrela Ach. 15(5)
V. knowlesiae P.M.McCarthy 1(0)
V. latebrosa Körb. 0(1)
V. macrostoma Dufour ex DC. f. macrostoma 35(5)
f. furfuracea de Lesd. 51(0)
V. margacea (Wahlenb.) Wahlenb. 3(7)
V. maura Wahlenb. 6(3)
V. mucosa Wahlenb. 8(1)
V. muralis Ach. 176(2)
V. murina Leight. 9(3)
V. nigrescens Pers. 181(0)
V. ochrostoma (Borrer ex Leight.) Trevis. 0(1)
V. pinguicula A.Massal. 2(3)
V. polysticta Borrer 1(0)
V. praetermissa (Trevis.) Anzi 13(1)
V. rheitrophila Zschacke 5(1)
V. sandstedei de Lesd. 1(0)
V. scabra Vězda 1(0)

V. simplex P.M.McCarthy 1(0)
V. striatula Wahlenb. 3(2)
V. viridula (Schrad.) Ach. 155(3)
Vezdaea acicularis Coppins 1(0)
V. aestivalis (Ohlert) Tscherm.-Woess & Poelt 5(0)
V. leprosa (P.James) Vězda 6(0)
V. retigera Poelt & Döbbeler 4(0)
V. rheocarpa Poelt & Döbbeler 2(0)
Vulpicida pinastri (Scop.) Mattson & M.J.Lai 0(2)

Weddellomyces epicallopisma (Wedd.) D.Hawksw. [LF]

Xanthoparmelia conspersa (Ehrh. ex Ach.) Hale 15(17)
X. loxodes (Nyl.) O.Blanco et al. 1(0)
X. mougeotii (Schaer. ex D.Dietr.) Hale 8(12)
X. verruculifera (Nyl.) O.Blanco et al. 5(0)
Xanthoria aureola (Ach.) Erichsen 2(0)
X. calcicola Oxner 140(1)
X. candelaria (L.) Th.Fr. 141(1)
X. elegans (Link) Th.Fr. 28(4)
X. parietina (L.) Th.Fr. 188(1)
X. polycarpa (Hoffm.) Th.Fr. ex Rieber 103(3)
X. ucrainica S.Y.Kondr. 4(0)
Xanthoriicola physciae (Kalchbr.) D.Hawksw. [LF]
Xylographa parallela (Ach.) Belhen & Desberger 1(0)

Zwackhiomyces coepulonus (Norman) Grube & R.Sant. [LF]

PUBLISHED SOURCES OF YORKSHIRE LICHEN RECORDS

The following published sources, additional to those listed in Hawksworth and Seaward (1977) and Seaward (1994), have been used in the compilation of the above checklist.

Henderson, A. (1995) Stones, cups-and-rings and lichens: a study of lichen distribution on the carved rocks of Rombalds Moor. *Bull.Yorks.Nat.Un*. **24**: 20-21.

Henderson, A. and Crossley, R. (2005) *Peltigera neckeri* in Yorkshire. *Bull.Yorks.Nat.Un*. **43**: 48-49.

Middleton, P. and Lunn, J. (2001) Bryophytes and lichens of colliery spoil heaps in Yorkshire. *Naturalist* **126**: 151-156.

Seaward, M.R.D. (1997) Progress in the study of the Yorkshire lichen flora - 2. *Naturalist* **122**: 57-59.

Seaward, M.R.D. (2004) The lichen flora of Hull, with particular reference to zonal distribution and environmental monitoring. *Naturalist* **129**: 61-66.

Seaward, M.R.D. and Giavarini, V.J. (2007) The lichen flora of Hull: biodiversity update, 2002-2006. *Naturalist* **132**: 41-49.

Seaward, M.R.D. and Henderson, A. (1994) Preliminary study of the lichen flora of Spurn Point, East Yorkshire. *Naturalist* **119**: 151-154.

Seaward, M.R.D. and Henderson, A. (1999) Lichen flora of the West Yorkshire conurbation – supplement VI (1994-98). *Naturalist* **124**: 113-116.

Seaward, M.R.D. and Pentecost, A. (2001) Lichen flora of the Malham Tarn area. *Fld Studies* **10**: 57-92.

The following lichenology reports of Yorkshire Naturalists' Union excursions from 1996 onwards, mainly contributed by A.Henderson, published in *The Naturalist* have also proved a valuable source of records: **123**: 39-40, 45, 46, 126, 129, 131, 135-136 (1998); **124**: 119-120, 122, 125, 127-128, 130 (1999); **125**: 85, 87-88, 89, 174-175, 178, 180-181, 185 (2000); **126**: 33, 38, 41, 44, 47-48 (2001); **127**: 150-151, 156, 162-163, 165-166,

171-172 (2002); **129**: 16, 18, 21, 25, 27-28, 31-32 (2004); **130**: 67, 72, 75, 78, 140, 142, 145, 147, 152 (2005); **131**: 143-144, 151, 153 (2006).

Excluded Taxa

Listed here are species (a) awaiting ratification or clarification and (b) previously published as occurring in Yorkshire, being based on doubtful or dubious records unsupported by herbarium material unless otherwise stated, that are additional to those enumerated in Seaward (1994).

Acarospora complanata H.Magn. – details lacking
Arthonia excipienda (Nyl.) Leight. [LF] – unlikely (*Coppins in litt.*)
A. galactites (DC.) Dufour – records unconfirmed
Arthopyrenia rhyoponta (Ach.) A.Massal. = *A. punctiformis*
Bacidia hegetschweileri auct. (= *B. vermifera* (Nyl.) Th.Fr.) – all records deleted (Coppins *in litt.*)
Biatora vernalis (L.) Fr. – records unconfirmed
Brigantiaea fuscolutea (Dicks.) R.Sant. – records unconfirmed
Buellia saxorum A.Massal. – record unconfirmed
Calicium quercinum Pers. – records unconfirmed
Caloplaca arenaria (Pers.) Müll.Arg. – record unconfirmed
Catillaria globulosa (Flörke) Th.Fr. – old record = ? *C. griffithii*
Chrysothrix chrysophthalma (P.James) P.James & J.R.Laundon – old record supported by specimen in herb. MANCH, but provenance questionable
Cladonia deformis (L.) Hoffm. – probably *C. sulphurina*
C. phyllophora Hoffm. – Mudd material in BM = *C. squamosa*
Collema dichotomum (With.) Coppins & J.R.Laundon – all old records supported by herbarium specimens have proved to be errors
Dactylospora saxatilis (Schaer.) Hafellner [LF] – details lacking
Dermatocarpon miniatum var. *complicatum* (Lightf.) Hellbom – not a worthy taxon (Coppins *in litt.*), but some of records probably refer to *D. intestiniforme*
Hypogymnia vittata (Ach.) Parrique – old record supported by specimen in herb. MANCH, but provenance questionable
Lecania fuscella (Schaer.) Körb. – old record probably *L. naegelii*
Lecanora cenisia Ach. – old records unconfirmed
Lecidella pulveracea (Schaer.) P.Syd. – old record unconfirmed
Lepraria frigida J.R.Laundon = *L. eburnea*
L. neglecta (Nyl.) Lettau – most, if not all, records probably *L. caesioalba* (Coppins *in litt.*)
Opegrapha parasitica (A.Massal.) H.Olivier [LF] – records unconfirmed
Pertusaria excludens Nyl. – records unconfirmed; probably *P. lactescens* (Coppins *in litt.*)
Placynthium garovaglii (A.Massal.) Malme – records unconfirmed
Polyblastia theleodes (Sommerf.) Th.Fr. – modern record = *Sporodictyon schaererianum*; old records unconfirmed
Porpida flavicunda auct. – details lacking
Pyrenula dermatodes (Borrer) Schaer. – no confirmed records from England (Coppins *in litt.*)
P. laevigata (Pers.) Arnold – doubtful (Coppins *in litt.*)
Sarcogyne clavus (DC.) Kremp. – old record unconfirmed
Squamarina cartilaginea var. *pseudocrassa* (Mattick) D.Hawksw. – included within *S. cartilaginea*
Teloschistes chrysophthalmus (L.) Th.Fr. – old record supported by specimen in herb. MANCH, but provenance questionable
Usnea fulvoreagens (Räsänen) Räsänen – old record unconfirmed
Verrucaria acrotella Ach. – record unconfirmed

Xanthoparmelia pulla (Ach.) O.Blanco et al. – old records unconfirmed
Xanthoria fulva (Hoffm.) Poelt & Petutschnig – incorrectly reported from Yorkshire

ACKNOWLEDGEMENTS

The author is greatly indebted to Dr Brian Coppins for his invaluable comments on a draft of this checklist, and to the many lichenologists who have furnished him with Yorkshire lichen records in recent years, more particularly Mr S.Chambers, Dr B.J.Coppins, Mr P.M.Earland-Bennett, Mr P.M.Earland-Bennett, Dr A.Fryday, Mr V.Giavarini, the late Dr O.L.Gilbert, Mr A.Henderson, Dr C.J.B.Hitch, Mr A.Orange and Mr D.H.Smith.

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BOOK REVIEWS

The Ferocious Summer by **Meredith Hooper**. Pp.xx + 299, including 1 map 16 pages of colour plates. 2007. Profile Books, London. £20.00 hardback.

This book presents a different perspective on the Antarctic. It recounts the daily lives of Adélie penguins during the breeding season of 2001/2. The author worked alongside the staff at Palmer Base on the Antarctic Peninsula, observing the life and breeding success, or lack of it, of the Adélie Penguins and other wild life. There is a good background introduction to the Antarctic but the main body of the book is a diary of daily work at the American research base. What soon becomes clear is that scientific work in these extreme conditions is hard, repetitive, meticulous and at times hazardous. The interesting and well written text really brings home the problems that climate change is causing to many groups of organisms – indeed, the fact that some are on the road to extinction. It is also interesting that the Antarctic is one of the regions on our planet that is suffering the greatest average temperature rise, with resulting dramatic changes to the habitats. The fate of the Adélie Penguins is a portent of the possible future fate of many species, including humans, if we don't act now to alleviate global warming.

This is an interesting, well written and very readable book, highlighting not only climate problems but also the very difficult life of scientists working in such extreme habitats.

EGB

Silent Fields. The long decline of a nation's wildlife by **Roger Lovegrove.** Pp. 404, with 29 b/w figures, plus 40 line illustrations of individual species by **Ross Lovegrove**. Oxford University Press. 2007. £25.00 hardback.

As the author of this book remarks, it is a sad indictment of the past abuse of wildlife in Britain that one of the priorities for conservation has to be the recovery of species that were deliberately eliminated in previous centuries. He charts the history of destruction of terrestrial wildlife from the time of the Tudor Vermin Acts, of which the first was introduced in 1532, to the present. There were even earlier Acts in Scotland but their effects are little known, whereas in England and Wales Churchwardens' Accounts of payment for 'vermin' provide a rich, if erratic, source of information that has been painstakingly exploited by the author who has examined almost 1600 such lists from all the ancient counties of England and Wales. The earliest perused was for 1527, from Wing in Buckinghamshire: the earliest for Yorkshire, of which the sample of 91 is the largest for any county, is for Masham in 1542, whose record continues to 1677.

While it is easy, from the comfort of a well-fed present, to be critical of legislation that later led to the slaughter of vast numbers of birds and mammals, the initial intention was to protect the grain harvest, and successive Acts in Elizabethan times were passed in a period of severe winters, bad harvests and even famine – though the victims included a motley assortment of species that could hardly be accused of eating grain. Later slaughter was also often based on ignorance, and eventually carried out in the interest of game preservation. There were over 23,000 gamekeepers in 1910, "whose primary function was to remove predators". These onslaughts, and even earlier killing for the fur trade, went hand in hand with vast changes in the countryside, some of which had adverse effects on various species, and had much earlier contributed to the elimination of the Brown Bear, Wolf, Wild Boar, Beaver, and others. The introduction of alien species including Rabbit, Grey Squirrel, Brown Rat and American Mink, and, it might have been mentioned, the Pheasant, have been added complications. All these things are considered in this compendium of information, which includes a long species by species account of the victims. Although often a recital of facts, these are well presented and interest is sustained, though the tale – or toll – of slaughter is horrendous. Estate records, where available, present some of the most appalling figures. Others may share my surprise that 5,904 Hedgehogs were killed at Sandringham between 1938 and 1950, and 5,623 at Holkam between 1953 and 1959. Since then road kill has taken its toll on this unfortunate insectivore and the now diminishing number of flattened carcasses simply reflects a drastic decline in numbers. Earlier records of slaughter on Scottish estates are even worse and cover a multitude of species – though the oft-cited figures for Glengarry in the early 19th century need to be taken with a pinch of salt.

As the author says, this persecution was formerly carried out "untrammelled by concerns for morals, public attitudes, legal constraints, or thoughts of extinction". Times change, and all these factors are now supposedly taken into account – yet 85% of those convicted of raptor persecution since 1985 had a game interest, and most were gamekeepers. In general the public is ignorant of the scale of illegal persecution of wildlife that is still carried out in the name of vermin control. The author is no unthinking 'animal lover' and appreciates the need for intervention at times. How many opponents are there to the control of the Brown Rat? How, he rightly asks, can we manage our wildlife today as part of the rural fabric and economy? With increasing populations of the Buzzard, the bringing back from the brink of extinction of the now flourishing Peregrine Falcon, and successful re-introductions of the Sea Eagle and Red Kite to point the way, we are making progress. Read this book in order to be well informed about the complexities of the biology and vested interests involved, and thereby be in a position to ensure that further progress can be made.

GF

DISTRIBUTION OF RED SQUIRRELS *SCIURUS VULGARIS* IN THE YORKSHIRE DALES NATIONAL PARK, 1990-2006

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INTRODUCTION

Although formerly widespread, there has been a population decline and range contraction of the Red Squirrel (*Sciurus vulgaris*) population in Britain since the early 1900s (Corbett & Harris, 1991; Dutton, 2004), primarily as a result of the introduction of the Grey Squirrel (*S. carolinensis*) from North America as well as habitat loss and fragmentation. Within Yorkshire, the Red Squirrel was recorded in 153 of its 198 10 x 10 km squares at the start of the 20th century but, despite a number of temporary localised population increases in several areas, the population was restricted to only 73 such squares in the county by 1983 (Delany, 1985).

There appears to be very little recent published information on the distribution of Red Squirrels within the Yorkshire Dales. Although Red Squirrels continued to survive in the Cumbrian area of the National Park (the parishes of Dent, Garside and Sedbergh), it was widely believed that they had disappeared from areas in VC65, North-west Yorkshire. In the 1990s, Red Squirrels were recorded again in VC65 in the Hawes area (Hugh Kemp *pers. comm.*), since when, staff from the Yorkshire Dales National Park Authority (YDNPA) and North West Red Alert, Red Squirrel Conservation Partnership (now superseded by Save our Squirrels) have been collating records from local residents and working to encourage submission of Red and Grey Squirrel sightings from within the area.

The distribution of Red and Grey Squirrels is dependent on suitable woodland cover. This is relatively low in the Yorkshire Dales National Park, with only 4.54% of the area identified as woodland. The Cumbrian Dales of Dentdale and Garsdale remain relatively well wooded comprising a mixture of broad-leaved woodlands, hedgerow trees and isolated blocks of conifer woodland (YDNPA, 2007). In North Yorkshire, the adjacent area of Wensleydale in Richmondshire is markedly different, with relatively little woodland cover apart from the side dale of Widdale where there are a number of small (< 90 ha) conifer woodlands (YDNPA, 2007). The largest conifer woodland in the National Park is Greenfields Plantation in Langstrothdale, Craven covering c. 1,200 ha.

Given the decline of Red Squirrel populations, the North of England Red Squirrel Conservation Strategy was published in 2005 by Red Alert North England, a partnership which includes the Wildlife Trusts and the Forestry Commission as well as landowners, businesses, and local community representatives. This identified 16 carefully selected Red Squirrel Reserves where their populations were considered to have the best chance of long-term survival. Conservation efforts are now focused on, and adjacent to, these reserve areas. There are two such areas within and adjacent to the Yorkshire Dales National Park in Widdale and Garsdale and Mallerstang.

In the Red Squirrel Reserve Areas, generic guidelines published by the Forestry Commission recommend management specifically for the benefit of Red Squirrels which primarily focuses on providing a continuous area of suitable cone bearing woodland. Around each reserve area there is a 5 km buffer zone where it is recommended that management aims to improve the habitat for Red but not Grey Squirrels; this means not planting any large seeded broad-leaved tree species such as Sessile Oak (*Quercus petraea*) or Hazel (*Corylus avellana*) that are favoured by Grey Squirrels. Grey Squirrel control is encouraged in both the reserve and buffer areas.

This paper compares the records of Red Squirrels in the Yorkshire Dales National Park collated for the periods 1990-1999 and 2000-2006.

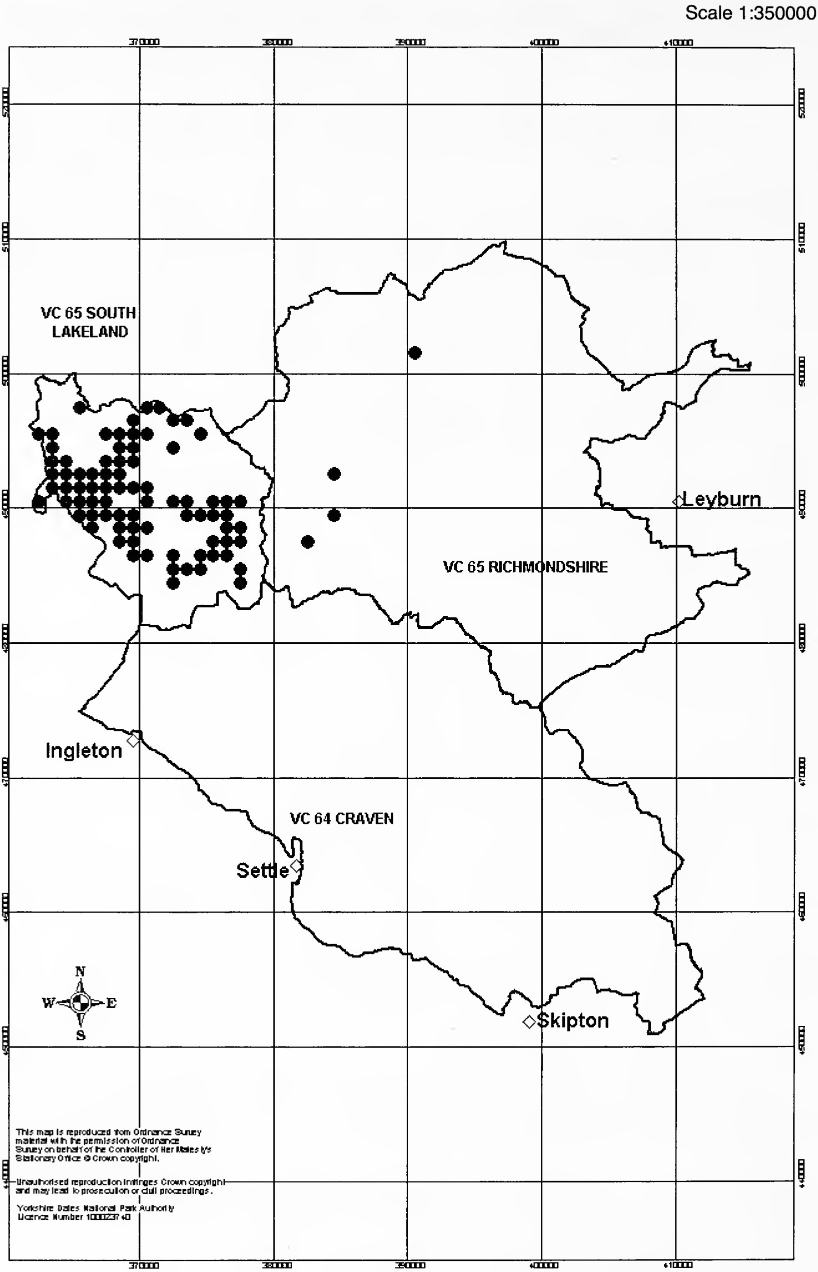

FIGURE 1.
Red Squirrel distribution in the Yorkshire Dales National Park between 1990 and 1999.

Methodology

Records have been collated from a number of sources. The majority of the records from the parishes of Dent, Garsdale and Sedbergh (VC65) have been kindly supplied by the Sedbergh Red Squirrel Group whose members have been diligently recording Red and Grey Squirrels for many years.

Records from within North Yorkshire initially came from a small number of landowners in the Widdale area. More recently, the Yorkshire Dales National Park Authority and North West Red Alert staff have been encouraging the reporting of Red and Grey Squirrel records, primarily in the Yorkshire area of the National Park, via a variety of sources including press releases, interpretive displays, information leaflets and further liaison with landowners and local residents. In addition, North West Red Alert kindly supplied records from Cumbria and North Yorkshire up to 2006. The records from all sources include visual sightings, records of trapped or shot Grey Squirrels, and results from hair tube survey work undertaken in 2005 and 2006 (Court *et al.*, 2007a).

All records have been inputted into a YDNPA database and plotted using MAPINFO, a Geographical Information System (GIS), to show distribution of Red Squirrels on a 1 x 1 km basis. In addition, Red Squirrel Reserve Area and Buffer boundaries have been plotted using a GIS layer supplied by the Forestry Commission.

Results

The records of Red Squirrels in the Yorkshire Dales National Park in the periods 1990-1999 and 2000-2006 are shown in Figures 1 and 2, respectively. It should be noted that these records relate only to the distribution and not to the density of Red Squirrels. The numbers of records of Red Squirrels between 1990 and 1999 and annually from 2000 to 2006 are shown in Table 1. It should be noted that one record may relate to more than one squirrel seen at the same location, at the same time on the same day. Therefore the numbers represent the number of records submitted and not the number of squirrels recorded. The locations of Red Squirrel Reserve areas and buffer zones in the YDNP are shown in Figure 3.

Table 1.
The number of Red Squirrel records in the Yorkshire Dales National Park between 1990 and 2000, and annually from 2000 to 2006.

Year	1990 to 1999	2000	2001	2002	2003	2004	2005	2006	Total 2000 to 2006
No. red squirrel records	865	78	52	83	102	115	97	63	590

The results show that in the Yorkshire Dales National Park, Red Squirrels were recorded in 79 1 x 1 km squares in Cumbria and four in Richmondshire during 1990-1999; this compares with records from 65 1 x 1 km squares in Cumbria, 21 in Richmondshire and one in Craven during 2000-2006.

Discussion

The results initially suggest that the distribution of Red Squirrels has declined in the Cumbrian area of the Yorkshire Dales National Park since 2000. However, it should be taken into account that there are ten years of records from the 1990s, compared with only seven years of records from 2000 onwards. This relates to a difference of 865 Red Squirrel records in the former and 590 in the latter period and may account for some, or all, of the

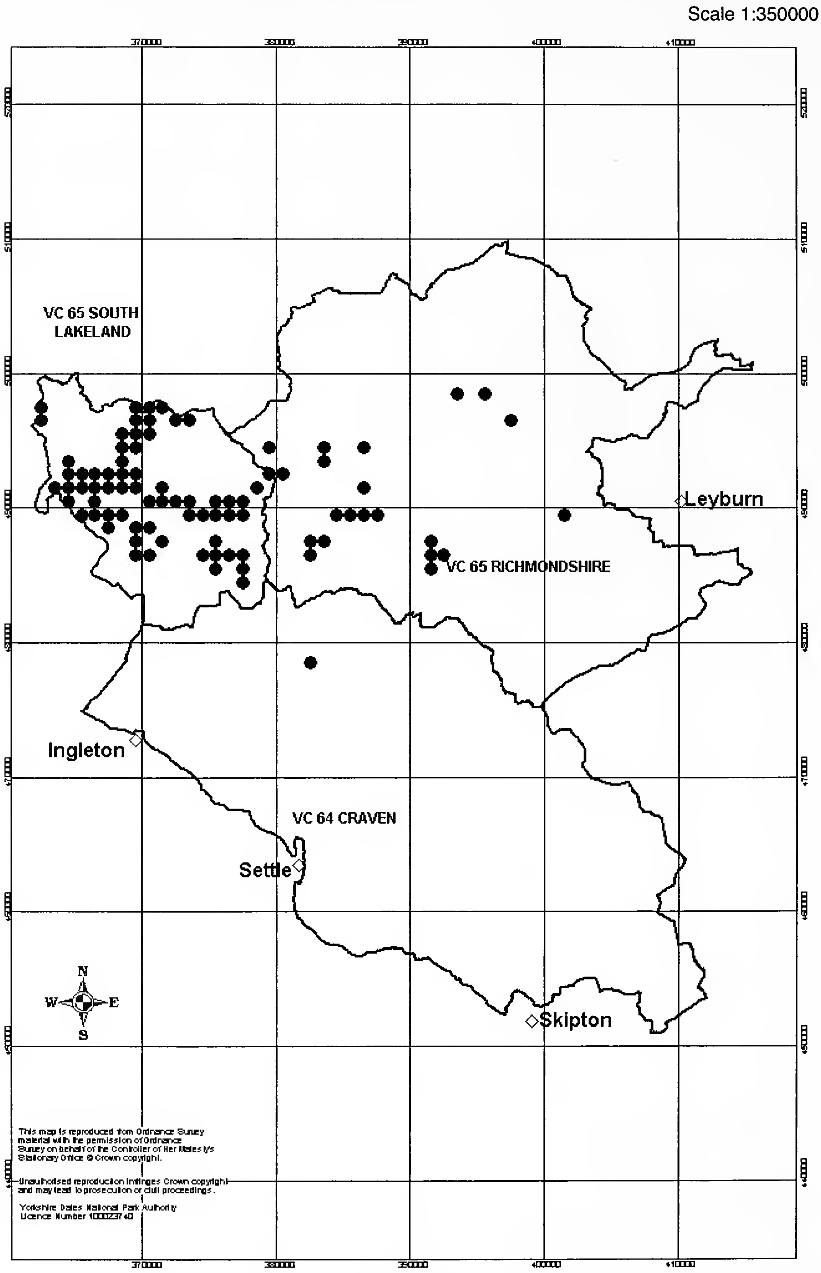

FIGURE 2.
Red Squirrel distribution in the Yorkshire Dales National Park between 2000 and 2006.

Scale 1:350000

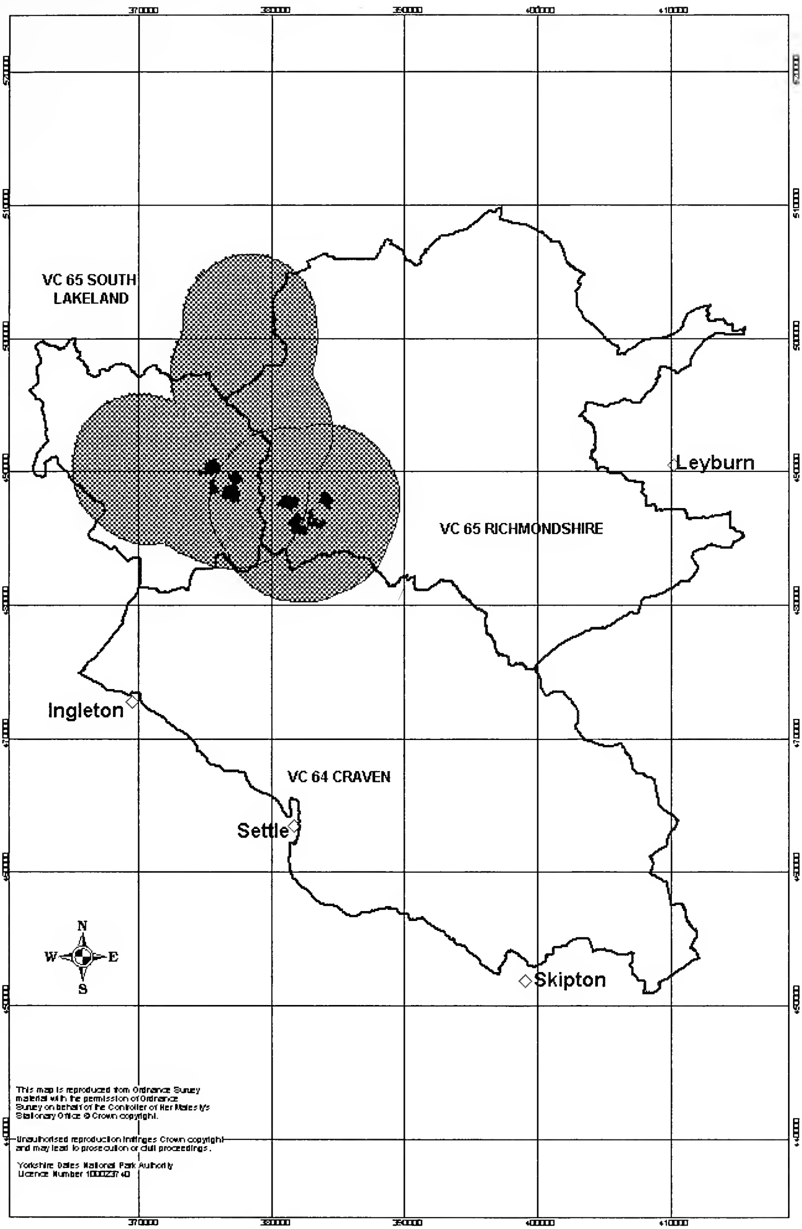

FIGURE 3.
Location of Widdale and Garsdale & Mallerstang Red Squirrel Reserves (shaded black) and buffer zones (dotted)

apparent range contraction. The authors recommend that further analysis is undertaken when records up to and including 2009 are available and a more accurate comparison can be made.

There has been a considerable increase in the distribution of Red Squirrels within the Craven and Richmondshire areas of the Yorkshire Dales National Park. An increased awareness of the presence of Red Squirrels in this area amongst local residents and the success of efforts to encourage submission of records will partly explain some of the increased distribution. In addition, hair tube survey work undertaken by YDNPA staff and volunteers at a number of sites in the Richmondshire area has resulted in records from previously unsurveyed woodland areas.

Whilst some of the range expansion in the Richmondshire area of the National Park can be explained by increased observer effort, the authors believe that there has been a genuine range expansion there; this is supported by an increase in the number of individual Red Squirrels recorded at several sites within the Widdale Red Squirrel Reserve Woodlands where Red Squirrels are frequently observed visiting bird tables.

Many of the conifer woodlands in the Widdale and Wensleydale area were planted in the late 1960s or early 1970s and so, depending on which species were planted, have only recently reached cone bearing age. The authors suggest that this relatively recent increase in food supply has enabled Red Squirrels, presumably moving into the area from adjacent areas of Cumbria, to colonise.

The site in the Craven area of the National Park where Red Squirrels have been observed refers to Greenfields plantation in Langstrothdale. Both Red and Grey Squirrels were recorded at one site within the woodland following a small live trapping project undertaken in 2004. Given the large area of potential suitability red squirrel habitat (>1000ha); further hair tube survey work is being undertaken to try and determine more about the distribution of Red and Grey Squirrels within the woodland (Court *et al.*, 2007b).

The results detailed in this report only refer to the distribution of Red Squirrels in the YDNP. As many of the plantations in the Dales have not yet reached the first thinning phase, the canopy cover is too thick to enable the standardised visual survey methods detailed by Gurnell *et al.* (2001) to estimate population density to be used. Population densities can also be estimated by establishing squirrel feeding transects and analysing fallen complete cones and the cone cores fed on by squirrels (Gurnell *et al.*, 2001), but none have been set up in the Dales.

Summary

Records of Red Squirrels within the Yorkshire Dales National Park have been collated for the period 1990-1999 and compared with those for 2000-2006. The results show that Red Squirrels were recorded in 83 1 x 1 km squares during 1990-1999 (79 in the Cumbrian and 4 in the Richmondshire areas of the National Park); this compares with records from 87 1 x 1 km squares during 2000-2006 (65 in Cumbria, 21 in Richmondshire and 1 in the Craven areas of the National Park). Although it appears that there may have been a range contraction in the Cumbrian area of the National Park, this could be explained by the temporal differences in the study periods. The range expansion in Richmondshire may be partially explained by increased observer awareness and record submission, as well as increased survey effort. However, the results strongly suggest that there has been a genuine increase in the distribution of Red Squirrels in the Richmondshire and Craven areas of the National Park.

Acknowledgements

The authors would like to thank all the individuals who submitted Red Squirrel records over the past 16+ years, in particular, Jason Reynolds (North West Red Alert), as well as the Very Reverend Ingram Cleasby, Jackie Foot and Roger Moore and other members of the Sedbergh Red Squirrel Group who have been reporting squirrel sightings for many years. We are also grateful to Hugh and Jane Kemp for their Widdale area records since the

late 1990s, to Matt Neale (YDNPA Area Ranger, Upper Wensleydale) for co-ordinating the Red Squirrel survey work in Upper Wensleydale and Widdale, and to all the YDNPA Dales Volunteers who have contributed to this survey work. We are also grateful to Peter Lurz for his useful comments during the preparation of this paper.

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BOOK REVIEWS

Beneath the Surface. A Natural History of a Fisherman's Lake by **Bruce M. Carlson.** Pp xiv + 250, illus. Minnesota Historical Society Press, St. Paul / Gazelle Books, Lancaster. 2007. £22.99 hardback.

This is a fascinating book describing the history, biology and the wild life of the Ten Mile Lake in Hackensack in Minnesota. The lake (5000) acres has only one small feeder and similar outlet, and is completely covered with thick ice for five months of the year; it holds millions of fish, comprising at least 39 species as well as a vast population of invertebrates. The author, who began his career as an ichthyologist, is Professor Emeritus in Anatomy and Cell Biology at the University of Michigan. For more than 50 years he has vacationed, fished and studied the ecology of the lake. The book is superbly illustrated with pencil, ink and water colour drawings by Bruce Granquist.

There are 13 chapters, six of which concentrate on the fishes, their behaviour and lake fishing technology past and present. The author deals with the battle and motivation to conserve the populations of the Beaver, Muskrat and Otter; he describes (complemented by delightful illustrations) the arduous daily life of their families throughout the seasons, such as the problems of domestic as well as airborne pollution, especially mercury, and of bank erosion which can severely affect the spawning grounds of the small fish that are an important food source.

The chapter on the loon (the Great Northern Diver, *Gavia immer*) will be illuminating for ornithologists. A summer resident and breeder, it has a mastery of fish location, deep diving and rapid flight. Although it has now been given protection, it has to compete with the high speed leisure boats of the holiday visitors and general disturbances at the

perimeter of the lake. However, the author believes that its future looks bright, when one considers that during the 1960s 5000 loons were drowned in fishing nets in the Canadian Great Lakes. Today the Canadian dollar carries the imprint of the loon, fondly called the loonie, and in 1961 the loon became the state bird of Minnesota.

There are detailed life histories of the small fish (*ciscos*) and the invertebrates that inhabit the lake and provide the basic food supply of the fishes. The author also investigated the wanderings of the large fishes for 24 hours per day using transmitters inserted surgically into the body cavity of walleyes, and this has indicated the part that sound and vibration plays in the movements of predatory fish even under the ice in the deep winter.

The work should appeal to conservation-minded field naturalists and perhaps surprise some anglers who pursue predatory fish. It will be given a place alongside the classic works in my library for as well as a good read it will prove to be an excellent reference work .

LM

The Ornithologist's Guide to the Islands of Orkney and Shetland by **Robert Dunn**, with a Foreword by **Martin Limbert**. Pp. 128, with several drawings & maps. Peregrine Books. 2007. £30.00 hardback (incl. p. & p.) from Peregrine Books, 27 Hunger Hills Avenue, Horsforth, Leeds LS18 5JS.

The main part of this fascinating book is a facsimile of Dunn's travels and experiences in 1831 and 1833 as a collector naturalist to these then remote islands. It is a thoroughly absorbing read, written in the often quaint and colourful style of the period when the English language conveyed atmosphere as well as plain facts; for example, 'The swell being very heavy at the time, we durst not approach as near to step out the boat upon the rocks but had to watch the opportunity of a swell raising us so that we could spring out upon them…' – one can almost taste the salt! After being swept into the sea, he goes on to say 'I fortunately got hold of the rocks with both hands, but was obliged to remain for a few seconds lying at full length, with the gun under my breast, destitute of the power of getting any higher and the sea washing up to my neck at every swell…'. There are several such accounts of adversity, disappointment and excitement, laced with stories of collecting eggs and shooting specimens, as 'The weather was stormy, and a heavy swell was setting on the islands, but I managed to shoot a female Eider Duck, and took the nest with five eggs'.

The hardships endured by these early naturalists are difficult to imagine today, living as we do in such a cosseted environment, the lucid accounts of the conditions and experiences stirring the blood.

Dunn's account ends with a complete list of all the birds and mammals which he encountered, with notes on their status. There is a most valuable 17-page biographical chapter on Dunn by Martin Limbert, written in his meticulous style with 11 pages of references and notes.

Not a book for the modern 'twitcher', but more serious naturalists will revel in its nostalgia. Perhaps a little expensive for some, but no more so than several other much less worthy publications which cram the bookshelves.

JRM

THE WHEATLEY ELM: A FADING PART OF YORKSHIRE'S ARBORICULTURAL HERITAGE?

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The Wheatley Elm: a tangle of genetic roots

The native elms of Britain vary tremendously, hybridise promiscuously and are notoriously difficult to identify. Over the centuries botanists and horticulturalists have attempted to name and classify them, seemingly coming to different conclusions. At one extreme Loudon (1838) lists 18 varieties of the English or common Small-leaved Elm (*Ulmus campestris* L.) and Nicholson (1887) lists 21 subspecies. Other 'splitters' have claimed up to seven species and 12 recognisable hybrids (Melville 1975, Stace 1992), whereas at the other extreme some 'lumpers', e.g. Richens (1983), recognise just two very variable species.

Recent thinking on the subject is something of a compromise. Stace (1992) recognises four species: the Wych Elm (*Ulmus glabra*), English Elm (*U. procera*), Small-leaved Elm (*U. minor*) and Plot's Elm (*U. plotii*), whereas Coleman (2002) recognises only three, regarding *U. plotii* as an unrelated clone of unknown origin.

To trace the thinking on the taxonomy and origins of the so-called Wheatley Elm we must investigate the subspecies and variants of *Ulmus minor*, referred to variously as Small-leaved Elm (Stace 1992) and Smooth-leaved Elm (Coleman 2002). Stace (1992) recognises three subspecies: the spreading and highly variable 'Small-leaved' (*U. minor minor*), the narrow but dome-crowned 'Cornish' (*U. minor angustifolia*) and the narrow and conical or pyramidal 'Guernsey' or 'Jersey' Elm (*U. minor sarniensis*).

The Wheatley Elm is a pyramidal, tightly and uprightly branched, columnar tree with a narrow pointed crown and small rounded glossy leaves, the elms' answer to the Lombardy Poplar. It is often confused with the Cornish Elm, but its branches are more stiffly erect and the tree more tapered. Mitchell (1996) comments "to the local authorities who used to plant it so extensively, it was the 'Cornish Elm', an error of identification that was almost hallowed by long usage. It is unclear why we now call it the Wheatley Elm, but it is an unambiguous and euphonious name and long may it stay".

Origins: the Guernsey connection

The parent tree from which the cultivated 'Wheatley Elm' was cloned seems to be the 'native' elm of Guernsey. The earliest documentary evidence of its presence on the island appears to be a description in MacCulloch (1815): "the species of elm on the island was of peculiar form, its branches tending upwards and giving the tree somewhat the appearance of a Lombardy Poplar".

It is possible that the Guernsey population originated from the adjacent Brittany coast where a similar (perhaps identical) elm exists, which due to its stiffly erect growth was naughtily referred to in early 19th century French texts *Nouveau Cours d'Agriculture* and *Dictionnaire des Eaux Forêts* as 'l'Orme male'. Interestingly, the evocative vernacular term 'Male Elm' is also used in Guernsey (Jee 1972).

By the early 19th century the tree's horticultural potential was already recognised and specimens (possibly a trial plot) were planted in the Royal Horticultural Society's gardens, probably in the 1820s, for by 1838 the celebrated and highly influential horticulturalist J.C. Loudon (1838) reported that they had reached 20ft in height.

The nurseryman and botanical illustrator George Loddiges (1784-1846), from the London Borough of Hackney, was one of the first to propagate this newly discovered elm from Guernsey, recognising in his catalogue of 1836 that the tree was sufficiently distinctive to warrant its own scientific name. He entitled it *Ulmus sarniensis* after Sarnia, the ancient name for Guernsey. It subsequently featured in the gardening literature of

Louden (1838), Nicholson (1887), Elwes and Henry (1913), Bean (1980), Hillier (1981), and virtually all subsequent compilations.

Who put the Wheatley in the Wheatley Elm?

Some time between the 1830s (when the tree appeared in the RHS gardens and received its own scientific name) and 1851, the story moves to Doncaster, South Yorkshire where Sir William Bryan Cooke (1782-1851), of Wheatley Park on the southern banks of the tidal reaches of the meandering river Don, propagated the tree and clearly became a passionate champion of its cultivation. Sir William, like most of the landed grandees of his generation, was a keen horticulturalist and had the distinction in 1833 of being the first President of the newly founded Doncaster Horticultural Society (Owen 1998).

The best clue as to the Cooke connection (and indeed the first documentary evidence of the term 'Wheatley Elm') occurs in an interview by C. W. Hatfield, the Doncaster journalist and local historian, with the Doncaster nurseryman Samuel Appleby (1806-1870) (Hatfield 1866). Appleby enthusiastically attested to Sir W.B.Cooke's "generous kindness in distributing young plants of this beautiful tree", remarking that he was "the least selfish man he had known and it was his pride to cultivate the Wheatley Elm, to present specimens to applicants ...".

Other Wheatleys

Although the tree may have been named Wheatley after a nursery, nurseryman or other place of the same name, which could possibly have attracted Sir William to champion a tree, there is no evidence of this and the tree was almost certainly named after his Wheatley Park in Doncaster.

Of the nine Wheatleys in England scattered through Cornwall, Durham, Hampshire, Nottinghamshire, Oxfordshire, and South and West Yorkshire, examinations of county botanical reviews have provided positive evidence for only South Yorkshire. It should be noted that Desmond (1977) gives no reference to anyone named Wheatley.

Entering the horticultural literature

Since the term 'Wheatley Elm' was evidently being used in Doncaster prior to Sir William's death in 1851 and certainly by Samuel Appleby prior to 1866, this local usage predates and (no doubt urged by Sir William's canvassing) is probably the origin of the term Wheatley or its Latinised form *Wheatleyi*, in commercial horticultural catalogues. Curiously, the earliest such reference is the 1869 catalogue of the nurseryman Leon Simon-Louis of Metz, in north-eastern France (Elwes & Henry 1913, Bean 1980, Mitchell 1996).

The commonly used vernacular term Guernsey Elm also has validity in recognising the tree's native roots but the widely used name Jersey Elm is something of a red herring since the few that ever existed there were in any event introduced from Guernsey (McClintock 1975).

Royal Patronage

The neat, immaculately attired Wheatley Elm clearly appealed to the well buttoned sensibilities of the Victorian era, and inevitably this novel, well regimented tree was deemed suitable for the avenue plantings at Queen Victoria's regal hideaway at Osborne on the Isle of Wight (Elwes & Henry 1913, Richens 1983).

Gardener's choice

Partly due to its neat and orderly shape, and no doubt influenced by the recognition of royal patronage, the Wheatley Elm became a favourite with horticulturalists and was commonly planted in city parks, especially in the Midlands (Mitchell 1981). In 1969, the Royal Horticultural Society, in recognition of its attractive form and garden worthiness, bestowed on Wheatley Elm and its golden sport 'Dickson's Golden Elm' their Award of Gardening Merit. Ironically this accolade was swiftly followed by the Dutch Elm epidemic to which the Wheatley clone was particularly vulnerable. The national tree expert Alan Mitchell

(1981), recommending single specimen trees capabale of attaining monumental size, lamented that until ten years ago (1971) the Wheatley Elm, with its splendidly shaped conic crown of fine shoots, would have been one of the first on the list, but it could no longer be planted in expectation of a fine specimen 50 years hence and must be omitted.

CULTIVARS

In 1900, the nurseries of Messrs Dickson of Chester raised a very attractive compact, slow-growing golden-leaved variety which they marketed as the 'Golden Cornish Elm' which is variously known as *Ulmus* 'Dicksonii' (Wheatley Aurea) and *U.* x *sarniensis* 'Dicksonii'. (Bean 1980, Hillier 1981). Fortunately illustrations of this rarity were published by the RHS (Bricknell 1989). There is also a 'Purpurea' variety which has a purple tinge to the young leaves, but its roughly hairy leaves, spreading branches and broader crown lead specialists to doubt any relationship to the Wheatley or Guernsey Elm (Bean 1980, Hillier 1981).

HIGHWAY ENGINEER'S CHOICE

Elms have long been part of the Doncaster landscape and on various occasions throughout the 18th and 19th centuries Doncaster Council specifically funded the planting of elms along strategic entrances to the town and its adjacent lands (Owen 1998).

Sadly the heavy-limbed English and Wych Elms have an alarming habit of unexpectedly shedding branches, as observed by Rudyard Kipling in 'A Tree Song':

> "Ellum she hateth mankind, and waiteth
> Till every gust be laid,
> To drop a limb on the head of him
> That anyway trusts her shade."

Due to its compact columnar form, the Wheatley Elm proved ideally suited to the stringent safety-conscious requirements of highway planting schemes, and avenues of Wheatleys became a hallmark of town entrances and ring roads from Plymouth to Edinburgh (Mitchell 1981). The Leeds Ring Road (A6120 between Moortown and Meanwood) still has some survivors and until 2000 there were several in the Steeton – Bilbrough – Askham Bryan area along the A64 Tadcaster to York road. There are still some along the broad boulevards of suburban Hull, e.g. Hull Road, Cottingham.

Its tolerance to salt spray, betraying its Guernsey origins, made the Wheatley Elm an ideal candidate for ornamental planting in seaside resorts; hence its presence even today in Scarborough, Bridlington, and Douglas, Isle of Man. It may also be able to withstand the extensive use of rock salt on highways in winter.

DONCASTER SURVIVORS: THE ELM IS DEAD – LONG LIVE THE ELM!

The Dutch Elm disease that swept through the Doncaster district in the 1970s and 80s caused the deaths of most mature and venerable elms of landscape significance. From 1973 to 1976 1,200 had been felled by the Forestry Commission and Local Authorities in South Yorkshire and in 1977 some 1,600 were deemed to be infected and targeted for felling and burning (Clouston & Stansfield 1979).

Today there are still many elm hedges around urban Doncaster, with vigorous growths of indefatigable suckers emerging from the rooting systems of the parent elms felled during the 1970s and 80s epidemic. It is possible that some of these may again develop into canopy trees and some, which had 'Wheatley' parentage, may again develop the characteristic columnar shape. Two such examples, alive in 2006 but dead in 2007, were in the hedge between the Clay Lane estate and Wheatley Hall Road, and on the Wheatley Hall Road boundary of ICI Fibres (later DuPont and now a car showroom), but significantly on the perimeter of what had been the Wheatley Park home of Sir W.B.Cooke. These were spotted by Andy Hill of the Doncaster Naturalists' Society and seem to have been Doncaster's last Wheatley Elms.

ILLUSTRATIONS OF A BYGONE TREE

Since very few Wheatley Elms survived the depredations of Dutch Elm disease, it is possible we may have seen the last of this elegant and useful tree; however, illustrations survive. A good specimen at Kew was figured in the *Gardeners' Chronicle* (**41**: 150, 1907) and one overlooking the Thames at Richmond, judged in 1913 to be the finest British specimen, is figured in Elwes and Henry (1913). An un-named urban roadside example is figured in Jobling and Mitchel (1974). Interestingly, some of the larger surviving local roadside specimens are traceable on some aerial surveys of Yorkshire. Where surveys were flown in sunny weather, the trees' characteristic tapering conical shadows betray their identities and precise locations. The Bridlington examples are so large and distinctive they can be individually identified by zooming in on the aerial photographs on Google-Earth on the internet.

ACKNOWLEDGEMENTS

Thanks are due to George Owen for information on early Doncaster gardeners, to Joe Walsh of Park Side Training Centre, Prestwich for invaluable interpretation of references in Elwes and Henry (1913), Jonathan Hazell, Technical Director of the Arboricultural Association for publicity, Ms Elizabeth Gilbert, Librarian at the Royal Horticultural Society for checking numerous references, to the late Mrs Tim Flint for information on highway populations in Leeds and Tadcaster, and to Andrew Hill of the Doncaster Naturalists' Society for alerting me to the last two Doncaster specimens.

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HEMIPTERA ON SEA WORMWOOD

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INTRODUCTION

The publication of Schuh *et al*. (1995) prompted the writer to investigate the mirid bugs living locally on Mugwort, Wormwood and related plants. The results of a preliminary investigation have been published already (Dolling, 1999). This study heightened my awareness of Sea Wormwood and its associated fauna on occasional visits to the north bank of the Humber, resulting in an accumulation of insect records, particularly of Hemiptera, from Paull to Spurn. Four species of bugs, belonging to four different families, have been detected on Sea Wormwood in this area. The localities in which they have been found are cited below, together with a four-figure grid reference (in parentheses). Records from Elstronwick relate to the fauna of a cultivated plant in my garden. All previously published Yorkshire records are also cited.

The taxonomy of wormwoods and their allies has frequently undergone revision and probably will do so again. The present position as regards Sea Wormwood (see, for example, Stace, 1991) is that the former Section Seriphidium of *Artemisia* is treated as a full genus, so that the plant's current name is *Seriphidium maritimum* (L.) Polj., not *Artemisia maritima* L. as in, for example, the *Flora of the East Riding of Yorkshire* (Crackles, 1990), in which the plant's distribution in VC 61 is mapped.

RECORDS

Europiella decolor (Uhler, 1893), family Miridae. A capsid bug which keys to *Plagiognathus albipennis* (Fallén) in Southwood and Leston (1959). It feeds on various wormwoods of the genus *Seriphidium* and also some of the species with narrow leaf-segments still retained within the genus *Artemisia*.

Published records (as *P. albipennis* but presumed to be referable to *E. decolor* because Sea Wormwood was recorded as the host plant): Middlesbrough (VC 62, *c*.45/52) 7.1933 (Thompson, *Naturalist* **59**: 85, 1934); Spurn, (54/4115?) 24-26.7.1953 (Woodroffe, *Naturalist* **79**: 97, 1954); Sunk Island (54/2716) 17.8.1986 (Flint, *Naturalist* **112**: 156, 1987) and (as *E. decolor*) from Weeton, Kilnsea and Elstronwick (Dolling, 1999), repeated here.

Author's records: Paull Holme (1823) 26.8.2004; Cherry Cobb Sands (54/2120) 31.8.2004; Stone Creek (54/2318) 19.9.1998 and 7.9.2004; Stone Creek (54/2319) 31.8.2004; Elstronwick (54/2332) 19.7.1997 and other dates; Weeton (54/3518) 3.8.1997; West of Lockham (54/3817) 1.8.2000; Kilnsea (54/4016) 16.8.2005; Kilnsea (54/4115) 8.1997; Spurn Nature Reserve (54/4114 & 4214) 31.8.2005.

Eupteryx artemisiae (Kirschbaum, 1868), family Cicadellidae. Le Quesne and Payne (1981) provide keys to separate this species from its relatives and indicate that it also feeds on *Artemisia abrotanum*.

Published records: Middlesbrough (VC 62, *c*. 45/52) 7.1933 (Thompson, *Naturalist* **59**: 85, 1934, as *Eupteryx abrotani*); Kilnsea (54/4115?) 7.1952 (Flint, *Naturalist* **79**: 22, 1954, as *Cicadella abrotani*).

Author's records: Paull Holme (54/1823) 26.8.2004; Cherry Cobb Sands (54/2120) 31.8.2004; Stone Creek (54/2318) 7.9.2004; Stone Creek (54/2319) 31.8.2004; Elstronwick (54/2332) 19.7.1997; Welwick Saltmarsh (54/3418) 16.9.2004; Kilnsea (54/4016) 16.8.2005; Kilnsea (54/4115) 7.1997; Spurn Nature Reserve (54/4114 & 4214) 31.8.2005.

Craspedolepta pilosa (Oshanin, 1870), family Aphalaridae (Psylloidea). Hodkinson and White (1979) regard it as rare and indicate the non-British *Artemisia nitrosa* as an

alternative host plant. The author's material from Weeton was confirmed as this species by Mr Hollis.

Published records: in view of the fact that all the material of the genus *Craspedolepta* that I have seen from Sea Wormwood on the Humber shore has proven to be *C. pilosa* it seems very likely that the following record is referable to this species: Sunk Island (54/2716) 17.8.1986 (Flint, *Naturalist* **112**: 156, 1987, as *C. malachita*).

Author's records: Paull Holme (54/1823) 26.8.2004; Stone Creek (54/2318) 7.9.2004; Weeton (54/3518) 3.8.1997; West of Lockham (54/3817) 1.8.2000; Kilnsea (54/4016) 16.8.2005; Kilnsea (54/4115) 7.1997.

Macrosiphoniella pulvera (Walker, 1848), family Aphididae. A sample of this dark green aphid, heavily bloomed with white wax, was kindly identified by Dr Eastop, who also provided notes on the appearance and host plant ranges of this and several other aphids that might be encountered on Sea Wormwood.

Author's record: Spurn Nature Reserve (54/4114) 31.8.2005.

Species not found

The following species of Hemiptera associated with Sea Wormwood have been found in Britain, but have not been encountered in Yorkshire.

Chlorita viridula (Fallén, 1806), family Cicadellidae. Le Quesne and Payne (1981: 14) indicate that this species is confined, in Britain, to Sea Wormwood in a few localities in the Thames Estuary. It was not found in the Humber survey.

Craspedolepta malachita (Dahlbom, 1850), family Aphalaridae. Both this species and *C. pilosa* have been misidentified by British workers as *A. artemisiae* Förster, perhaps leading to confusion of records. The published record of *C. malachita* from the Humber is almost certainly referable to *C. pilosa*. Hodkinson and White (1979) cite a few widely scattered records, from both inland and coastal sites, and indicate both *Artemisia absinthium* and *Seriphidium maritimum* as hostplants. These authors do not mention that the forewing of *C. pilosa* is spotted like that of *C. malachita* and their illustration (fig. 53, on p. 28) omits the spots, though spots are shown on the figure of *C. malachita* on the same page.

Other aphids, family Aphididae. Dr Eastop (*pers. comm.*) indicated that two *Artemisia*-feeding species, *Macrosiphoniella abrotani* (Walker, 1852) and *M. absinthii* (Linnaeus, 1758) have been found on Sea Wormwood, as has the rare *Coloradoa submissa* Doncaster, 1961, for which Sea Wormwood is the type host, and *Pleotrichophorus glandulosa* (Kaltenbach, 1843), normally living on *Artemisia vulgaris*.

Acknowledgements

It is a pleasure to thank my former colleagues Mr D. Hollis (Natural History Museum, London) and Dr V.F. Eastop (Associate, Natural History Museum, London) for their assistance with identification.

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BOOK REVIEWS

Philip's Guide to Birds of Britain and Europe by **Håkan Delin and Lars Svensson**. Pp 320. An identification guide to more than 500 bird species with over 1000 colour illustrations and maps, and some line drawings. Octopus Publishing, London. 2007. £9.99 softback.

As a bird ringer for the past thirty or more years, the name of Lars Svensson is well known to me. He is the author of the *Identification Guide to European Passerines*, a publication which might well be described as the "ringers' bible." I was, therefore, ready to be impressed by the Philip's Guide, but I found it rather a curate's egg – only good in parts.

There is much interest in watching birds today and the ways of doing so include watching and recording a particular site or "patch" and the energetic pursuit of rarities throughout the length and breadth of Britain and, even, the world. The manner in which the hobby is pursued is very much a matter of personal choice but, inevitably, one must start at the beginning and to do so calls for some assistance in the form of a guide, usable as a learning tool and as an aid to bird identification in the field.

The novice may well be confused by the bewildering array of guides currently available, from the softback pocket-sized book to an electronic version, so what were the authors' objectives in publishing this latest volume? The preface readily admits that the book has a predecessor, the *Hamlyn Guide to Birds of Britain and Europe*, first published in 1970, and revised a number of times; the rights to the title have now been acquired by Philip's who asked the authors to "update … and suggest improvements". Have they done so? I believe, despite some apparent reluctance initially, they have overall made a valiant effort: to update a 35-year old publication is not easy bearing in mind advances in taxonomy – not all of which can be reflected in a work of this size – and the greater involvement of the amateur through the medium of digital photography aided by a telescope (digiscoping) to produce excellent quality photographs of virtually every bird species occurring or likely to occur in Britain and Europe.

The well-intentioned 10-page introduction begins with uplifting words of encouragement which congratulate "anyone who becomes interested in birds" for embarking upon "a rich and enjoyable pastime" which is guaranteed to give a lifetime's enjoyment but, sadly, it has some shortcomings. While there appears to be logic and order, commencing with information on plumage stages, it has a number of deficiencies. Firstly, given that there is no glossary included in a book intended as an introductory guide, there is the not uncommon failure of the expert to avoid "jargon" with unexplained appearances of terms such as "remiges" and "passerines", probably meaningless to the novice and, maybe, even discouraging.

Subsequently, within paragraphs on juvenile plumage, the authors explain that some juvenile birds' plumages are "so different that it is conspicuous and may even cause identification problems in the field. Most of these different-looking plumages have been included on the plates but owing to lack of space not quite all. One example is the juvenile

plumage of the Dunnock". Does this mean that the Dunnock's juvenile plumage has been included or omitted? The illustration plate should clarify. There is a choice of three index styles – scientific names, common names and a "quick index" – and one would expect the common names index to be the first option consulted. Unfortunately, "Dunnock" does not appear in any index in this book! If one is sufficiently experienced to know the scientific name for Dunnock, one would be able to find the species described and illustrated on pages 212 and 213. To find Dunnock otherwise, one would have to know that they are alternatively known as Hedge Sparrows, which would lead to an alphabetical entry under Sparrows, or that they are Accentors but only "Accentor" and nothing more (bearing in mind there is also an Alpine Accentor) appears in the common name index. As a last resort, one could leaf through the *Guide* page by page (not necessarily a bad way of learning the various species' appearances) until arriving at p.212 to find Dunnock. Having at last found our objective, we have to decide whether the introductory paragraph tells us whether the Dunnock's juvenile plumage is shown or not. It isn't, and furthermore the two illustrations of Dunnock – one in a standing position and another, presumably a representation of a moment of the bird's flight, albeit somewhat spread-eagled in appearance – are rather dark and do not, in my view, give particularly life-like renditions of the species' usual appearance.

The remainder of the Introduction does have useful and helpful sections on songs and calls – a most important aspect of bird identification – and the pitfalls likely to be encountered in judging birds' size and appearance. Additionally, there is useful guidance on "Birdwatching strategy" covering the weather, the use of optical equipment and, essentially, the safeguarding of the birds and their habitats.

The book focuses on birds occurring reasonably commonly in Europe as breeders or migrants, but omits extreme rarities from North Africa and Asia Minor. A map (p.7) indicates the approximate geographic range of this *Guide*, which claims to be one of the first to adopt the new "standard" sequence of orders and families (said to reflect bird evolution), commencing with waterfowl and concluding with passerines.

Heading the sections for each order is a brief summary description of the species groups within that order; these will be of value, especially to novice bird watchers, and particularly so for the Warblers where there is additional information explaining the various genera. The layout for each species follows the now standard format, comprising a description and distribution map with facing illustrative plates; these plates, though relatively simple in content, are mostly of acceptable quality, albeit looking somewhat old-fashioned in style. Unfortunately, while the authors have elected to use the "new" species order in this book, they have omitted to update scientific names – for example, Blue Tit is still shown as *Parus caeruleus* (not *Cyanistes caeruleus*), with Crested Tit and the Coal Tit similarly erroneous – the fault of the authors, or the proof readers?

Overall, this volume would be reasonably acceptable as an introduction to bird watching and for use in the field. It is "pocket-sized" and should lead to correct species identification in most circumstances. There are several other Guides and Field Guides currently available, but at £9.99 the *Philip's Guide* is among the cheapest. It does not set out to be all things to all men and the ultimate test is "Would I buy it?" Probably not, but I would not necessarily discourage a novice from doing so, bearing in mind that none of the available field guides is the "complete item" and having a selection of reference works is always to be recommended.

JW

Philip's Guide to Butterflies of Great Britain and Ireland by **J.A. Thomas**. Pp. 176, incl. many colour photographs & other illus. Octopus Publishing, London. 2007. £9.99 paperback.

This is a re-publication of Jeremy Thomas's *RSNC Guide to Butterflies of the British Isles* (1986), later titled *The Hamlyn Guide to the Butterflies of the British Isles*, and out of print

for some 16 years. The original structure is retained, while the contents have been brought up to date and presented in a more contemporary and pocket-book style.

There are three parts. A 21-page introductory section describes life cycles, some aspects of ecology, and general guidance on observing butterflies, both adults and immature stages, in typical habitats. There are photographs, but gone are the earlier poster-style collages of butterflies in their habitats, and those descriptions are now melded in with the main text of this section, making for more streamlined reading. The next 21 pages provide a guide to the main family groups, followed by illustrated key identification features that enable the species within each family to be distinguished from one another. Richard Lewington has provided new, high-quality paintings showing underwing patterns viewed from the side in typical resting postures. As before, tables summarise flight phenologies and national distributions within each family. Discrimination between Wood White and Réal's Wood White based on genitalia is included. The three common Whites are now easily compared on a single double-page spread, and Duke of Burgundy is given "honorary Fritillary" status in this section. The bulk of the book comprises two-page accounts for each species summarising their natural history, distribution and conservation status. The text is largely as before, but carefully updated as appropriate; about one-third of the photographs have been replaced with new ones; maps show contemporary ranges; and Ken Oliver's life-cycle illustrations, which originally showed only egg, larva and pupa in colour but vegetation and habitat background in grey-scale, now have additional watercolour-like wash added to the background by Pete Mallinson, which although artistically attractive, make the immature stages stand out less clearly. Large Blue now has a full account, with information on public access to sites where it may be seen; here, and in the new paragraphs on Blues and ants in the introductory first section, the author modestly gives no hint that it was he who undertook these pioneering studies. A final few pages, as before, cover extinct, rare migrant, vagrant and accidental species with new and improved paintings, and there is a new feature showing a few day-flying moths; surprisingly, some of the moth paintings are less true to life than one would have expected (e.g. Silver Y, Chimney Sweeper).

There are many guides to butterflies. Possibly the most direct competitor is Richard Lewington's own *Pocket Guide to the Butterflies of Great Britain and Ireland*, published by British Wildlife Publishing in 2003 (slightly out-of-date), and just a bit smaller and more truly pocket-sized. Lewington gives an illustrated guide to the families, but no section emphasising, side by side, key differences between species within families. In Lewington the corresponding paintings are within the two-page description for each species; altogether there are possibly more of them (e.g. only Lewington illustrates how brown a female Common Blue can be), and those for immature stages are larger and clearer; Lewington, however, has no photographs. On balance I prefer the illustrations in Lewington. The species descriptions contain life-stage phenology charts and distribution maps that are very similar in both books. The text, however, is different. It isn't just that Thomas has room for a lot more text, it is also the sheer quality of it. Somehow, both in the introductory material and in the individual species accounts, he manages in a most accessible style to pack in a massive amount of relevant information, providing a guide to the study of butterflies rather than just to spotting them. So, for me, it is Lewington in the pocket in the field, and Thomas in the glove compartment or on the bookshelf – and, welcome back, old friend!

TJC

A Dictionary of Earth Sciences edited by **Michael Allaby**. Pp. xi + 654. Oxford University Press. 3rd edition. 2008. £11.99 paperback.

This excellent reference volume contains more than 6,000 A - Z entries covering geology, geomorphology, meteorology and oceanography, supported by c. 130 line drawings. More than 30 respected academics have contributed to the contents or acted as advisors to the work, creating an authoritative, up to date volume that is a creditable addition to the well

known and well respected series of Oxford paperback reference books.

All the definitions that this reviewer checked were clear. One attractive feature of the work is that asterisks are used to denote all cases where specialist words used in the definition are defined elsewhere in the dictionary. A further attractive feature is the appendix of recommended weblinks, which are all of a high standard, albeit heavily biased in favour of the geological sciences.

Additional appendices include a revised geological time scale (though it is a little surprising that the terms Tertiary and Quaternary are used in the diagram even though they were deemed obsolete by the International Commission on Stratigraphy in 2004). There are also appendices providing an up to date bibliography, and information on stratigraphic units, lunar and Martian time-scales, wind-strength scales and SI units.

Though no concise reference book can cover all the terms that may be encountered, this book met all of the challenges posed by the reviewer; surprisingly, even some terms, such as Biological Oxygen Demand (BOD), that are more strongly related to the biological sphere of knowledge were competently covered. This dictionary is likely to prove to be a reliable, handy and moderately priced source of reference for students of geology, physical geography and other geosciences.

DEC

Wales: British Regional Geology by **M.F. Howells.** Pp. x + 230 , including 133 full-colour illustrations, 8 tables & 3 b/w figures, plus a separate full colour bedrock geology map of Wales at 1: 625,000 scale. British Geological Survey. 2007. £18.00, softback [available on-line from: www.geologyshop.com].

This work provides a welcome revision of the two volumes of the *British Regional Geology* that formerly dealt with the geology of Wales. It updates the interpretation of the geology, drawing upon information obtained from recent exploration of the offshore areas of Liverpool Bay, Cardigan Bay and the Bristol Channel, and reinterprets other information in the light of contemporary knowledge of the movement of tectonic plates. The volume also provides a 12-page, up to date interpretation of the role of ice in shaping the Welsh landscape during the Pleistocene that will be of interest to geomorphologists and physical geographers.

This edition has used the advances made in colour printing since the publication of the two earlier volumes to great advantage. There are no less than 58 excellent colour photographs illustrating features of the landscape, 44 coloured maps showing geological attributes and 31 coloured illustrations of geological sections. The line drawings depicting key graptolites have also been refined, using a more definitive style than was used in the earlier volumes, though by presenting them in this way some of the artistry of the old illustrations has been lost.

The work follows the traditional chronological pattern of the *British Regional Geology* series of publications, commencing with the oldest rocks and working through to the most recent materials, but an interesting 6-page section on 'Geology and man' explaining how geology has influenced human welfare has now been added. There is also a 10-page section listing references, maps and other publications that comprehensively covers recent accessible publications.

The work should prove of interest not only to geologists, but also to geographers and geomorphologists as it provides a welcome, crisply presented, updated account of the geology of Wales.

DEC

Printed in Great Britain by Titus Wilson & Son, Kendal ISSN 0028-0771

July-September 2008

Number 1066
Volume 133

The Naturalist

A QUARTERLY JOURNAL OF NATURAL HISTORY FOR THE NORTH OF ENGLAND

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THE NATURAL HISTORY ELEMENT OF HENRY POWER'S *EXPERIMENTAL PHILOSOPHY* OF 1664: REFLECTIONS ON THE BIOLOGICAL OBSERVATIONS OF A 17TH CENTURY HALIFAX MICROSCOPIST

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INTRODUCTION

While the published writings of Henry Power (1623-1668), which appeared under the title *Experimental Philosophy* in 1663, but bear the date1664, are well known to historians of science and are available in a reprint of 1966, and while his contributions to science have received attention from several competent commentators (Cowles 1933; Cohen 1964; Webster 1963, 1967; Hall 1966; Hughes 2002) these have concentrated on his work in the physical sciences. Moreover, although Hall (1966) remarked that the microscopical observations are the most original part of his book – which also embraced mercurial and magnetic experiments – very little attention has been paid to the *content* of these observations, most of which were biological, and Power's contributions to natural history have therefore gone largely unremarked. While many of these are inevitably trivial and, not surprisingly, some of his statements are erroneous, they include others that are highly meritorious and deserve greater recognition than has been accorded to them. They are among the earliest accounts that show how the recently invented microscope revealed details of plants and animals in a way hitherto impossible, and was beginning to demonstrate the existence of minute forms of life of amazing complexity. His reports are also important in providing an insight into the sort of things that interested observers of nature at that time and of their attitude and approach to organisms and phenomena, and how they proceeded to investigate them. Not least they are also revealing of how little was known almost 350 years ago about even common plants and animals, and how difficult it was to appreciate the significance of some of their fundamental attributes which seem self evident today.

POWER THE MAN, HIS CAREER, AND HIS OBSERVATIONS SET IN CONTEXT

Power was the son of a wealthy Halifax cloth merchant and property owner. Although born in Nottinghamshire, he attended school in Halifax before becoming a student at Christ's College, Cambridge. While at university he was much influenced by Sir Thomas Browne, a friend of his father, then living in Norwich, who is believed by some to have practised medicine, or at least to have gained medical experience, for a time in Halifax, and to have written his famous *Religio Medici* there. This is disputed by others, but Hughes (2000) has given reasons for believing that he did reside there between 1634 and 1636, during which period he wrote *Religio Medici*. There is nothing to prove that he did not. Certainly Power enjoyed a long friendship with, and was a frequent correspondent of, Browne who, among many things, was a naturalist. As a result of this, and his association with like-minded individuals at Cambridge, who may have included the great naturalist John Ray, he developed a deep interest in science. After graduation in 1645 he remained in Cambridge studying medicine, but at some uncertain date returned to Halifax and began to practice there before he was admitted to the M.D. degree in 1655. There he married Margaret Foxcroft, whose father, Anthony, had earlier married his widowed mother and thus became both his father-in-law and his stepfather. He became friendly with members of the Towneley family of Towneley Hall near Burnley in Lancashire, who formed the nucleus of a group of individuals actively engaged in scientific pursuits (see Webster 1966), and especially with their leader Richard Towneley, with whom he carried out astronomical observations and did experiments in what we now refer to as physics; for example, using

the recently invented mercury barometer he made observations on changes in atmospheric pressure as he ascended 'Halifax Hill' and, with Towneley, exploited the greater height of Pendle Hill to extend these observations. A remarkable outcome of this collaboration is the independent discovery of 'Boyle's Law' in 1661 (Webster 1963, 1967; Cohen 1964). Throughout his life his circumstances were clearly always comfortable, which gave him the opportunity to exploit the advantages of his education and to pursue his interests in a way possible only to a minority. His medical practice was very extensive, covering much of the southern part of the West Riding and extending into Lancashire, and was largely confined to wealthy families. As Clay (1917) remarked, "there hardly seems a family of distinction that he did not attend", many of his patients being titled. Visits were made on horseback.

In 1656 he moved to New Hall, which he acquired from Anthony Foxcroft. The preface of his book, dated August 1, 1661, is signed 'New Hall, near-Hallifax' [sic] – actually Elland – a building sufficiently interesting to feature in Ambler's book on the old halls and manor houses of Yorkshire, where he lived for the rest of his time as a medical practitioner in Halifax. The Power family had a long association with New Hall which began several generations earlier when, in the early 16th century, a direct ancestor married a daughter of the Bossvile family of that place. Ambler (1913) helpfully tells us that this originally timber-framed house was built in the latter part of the 15th century and re-fronted with rubble stone by John Foxcroft about 1640 or shortly thereafter. Power himself made various alterations during his sojourn there. Although it has been suggested that he died at New Hall, Watson (1775) tells us that he moved from there to Wakefield, but gives no date. Clay (1917) and Webster (1967) say he moved in 1664, Hughes (2002) that he did so in 1666. He died in Wakefield on 23 December 1668, aged 45, as is made clear by a brass plate on the floor of the chancel of what is now Wakefield Cathedral, of whose Latin inscription Watson gives a copy.

Power was a child of his times, and it is not always easy to appreciate just how much of the scientific knowledge that today we accept automatically was unknown more than 300 years ago. Examples are cited where appropriate, but it should be noted at the outset that, like his contemporaries, Power was neither aware of the enormous diversity of living organisms, nor did he appreciate the need to identify precisely those that he observed. It was indeed often impossible to do so at that time, and the means of categorising species was clumsy and unsatisfactory. The binomial system of nomenclature had not been devised. As a consequence the exact identity of some of the animals that he observed is either difficult or impossible to ascertain. Another limitation of his book is the almost complete absence of illustrations from that section of it that deals with microscopy, where they were most needed. This is made all the more apparent by the splendid illustrations that adorn Robert Hooke's *Micrographia*, published in 1665, a book that has always overshadowed its immediate predecessor in a similar field. To the present-day reader, with almost 350 years of subsequent discovery to draw upon, some of Power's microscopical observations inevitably appear elementary. However, it has to be remembered that they had little to guide them. Moreover, although, we know from his correspondence that they were made with microscopes "as good as the world affordes", of which four were available to him in Halifax, by modern standards these were crude instruments which certainly suffered from both spherical and chromatic aberration. A trade card of John Yarwell shows two microscopes offered for sale in 1683, which emphasise the crudity of those available 20 years after Power had published his work, and rare surviving early instruments do likewise. Hooke (1665) describes and illustrates the microscope that he chiefly used during his own investigations, from which those used by Power could not have differed greatly. Of the limitations of his own instrument Hooke was well aware, and he reported that he had made "several Tryals with other kinds of microscopes" and describes ingenious modifications. An important point to notice at the outset is that there is no evidence from any of Power's observations that he ever used transmitted light. Restriction to the use of reflected light imposed by the design of early microscopes largely excluded the possibility of making certain discoveries.

It is worth noting that Hooke appreciated that a single lens could give a high magnification and a clearer image than a microscope in which light passes through two or three lenses, but there are many constraints in its use. Nevertheless Leeuwenhoek used single lens microscopes with amazing skill and versatility between about 1673 and 1718, and it was with such instruments that he discovered single-celled plants and animals, and even bacteria, the existence of all of which Power remained unaware. However, while in the hands of such a skilled user they revealed these things, they were unsuited to investigations of the kind pursued by Hooke and Power.

To set Power's microscopical observations in context it has to be remembered that the compound microscope was not invented until about 1610, and that the first published illustration of any animal of which details were revealed by the use of such an instrument is the depiction of a Honey Bee in 1625, issued as a broadsheet entitled *Melissographia.* This is usually attributed to Francesco Stelluti but while he, aided by Johannes Faber, elucidated the details, the drawing was made by Francesco Fontana and this was engraved by Mathias Greuter; an improved version of it appeared in 1630, as did an illustration of a beetle – a weevil – in a translation of the Latin poet Persius! Although produced with the aid of a microscope, these were not of microscopic animals. The first published depiction of any part of a plant made with the aid of a microscope is an engraving by Cornelis Bloemaert of the seed of *Hibiscus mutabilis*, viewed from three different aspects, that appeared in 1633 in *De Flora Cultura* by Giovanni Battista Ferrari. In recent years a large number of both pen and ink drawings and coloured illustrations, prepared by or for members of the Accademia dei Lincei in Italy, under the direction of its leader, Federigo (or Federico) Cesi, surfaced in Paris. That some such illustrations had been made was known, but that they survived was not. They include flowers, fruits and insects, but also coloured drawings, especially of fungi, ferns and mosses, prepared with the aid of a microscope, some of which bear dates, of which 1623 is the earliest and 1628 the most recent (see Freedberg 2002, who reproduces some of them). These, of which some just pre-date the publication of 'Stelluti's' Hive Bee, are the earliest illustrations of any organisms known to have been prepared with the aid of a microscope, though none was published until recently, and of course Power was unaware of their existence. Again, save perhaps for slime moulds, these were not microscopic organisms, but their study with the aid of a microscope revealed structures that were otherwise too small to resolve. In the few intervening years before this part of his book was completed some microscopic work on insects and arachnids – with one exception the subject of the first 29 of his observations – was attempted. Hodierna (1644) published some remarkably good observations on insect eyes; Fontana (1646) whose work, like that of Hodierna, Power had certainly not seen, referred to a cheese-mite (that could not have been described without the aid of a microscope), a fly, an ant, and a flea, and in a 45-page book Borel (1656) included some crude illustrations of various insects among a miscellaneous assemblage of objects seen under a microscope. The crudity of these illustrations notwithstanding, Pierre Borel (1620-1671) was one of the pioneers in the early application of microscopes to biological investigations. Charleton (1654), apparently Power's only English predecessor in this respect, had also used a microscope and reported at least one observation, and Hauptmann (1657) did likewise. The unreliable statements of Kirchner are mentioned later in a specific context. Power was therefore a pioneer in this respect, even though he was no draughtsman as is evident from the very few illustrations that are included in his book. His was in fact the first book on microscopy to be published in England, and, whatever their faults, his observations were by no means lacking in originality and give some idea of the state of knowledge at that time.

The full title his book is: "Experimental Philosophy, In Three Books: Containing *New Experiments, Microscopical, Mercurial, Magnetical.* With some *Deductions,* and probable *Hypotheses*, raised from them, in Avouchment and illustration of the now famous *Atomical Hypothesis*". It is not a title that appears immediately attractive to the modern reader! In his Preface he gives us an interesting glimpse of his attitude to science and to the small organisms that were being discovered, or whose structure was being revealed, by use of the

recently invented microscope, and enables us to obtain some understanding of how the natural world appeared to a curious naturalist in about 1660. How he viewed such matters is best appreciated by quoting some of his more pertinent passages. He begins by praising recent developments in optics that had provided the instruments of which he made use, and the way in which they had revolutionised our conceptions of the universe and of the complexity of the smallest of living things. "Dioptrical Glasses (which are now wrought up to that height and curiosity we see) are but a Modern Invention: Antiquity gives us not the least hint thereof, neither do their Records furnish us with any thing that does Antedate our late discoveries of the Telescope, or Microscope. The want of which incomparable Artifice made them not only erre in their fond Celestial Hypothesis, and Crystalline wheel-work of the Heavens above us*, but also in their nearer Observations of the minute Bodies and Smallest sort of Creatures about us, which have been by them but sleightly and perfunctorily described, as being the disregarded pieces and huslement of the Creation; when (alas!) those sons of Sense were not able to see how curiously the minutest things of the world are wrought". He goes on to say that "the curious Mechanism and organical Contrivance of those Minute Animals, with their distinct parts, colour, figure and motion, whose whole bulk were to them almost invisible [are such] that were Aristotle now alive, he might write a new History of Animals; for the first Tome of Zoography is still wanting, the Naturalist hitherto having onely described unto us the larger and more voluminous sort of Animals, as Bulls, Bears, Tygers, &c. whilst they have regardlesly pass'd by the Insectile Automata (those Living–exiguities) with only a bare mention of their name, whereas in these prety Engines (by an Incomparable Stenography of Providence) are lodged all the perfections of the largest Animals; they have the same organs of body, multiplicity of parts, variety of motions, diversity of figures, severality of functions with those of the largest size: and that which augments the miracle, is, that all these in so narrow a room neither interfere nor impede one another in their operations." While what he says here was true in the light of what was known in 1661, and while it gave him cause to marvel, he was unaware that future revelations of the microscope would shortly invalidate his belief, that so impressed him, that all minute organisms have the same multiplicity of parts as have large. The diverse world of the Protozoa, and of unicellular plants, was soon to be discovered. These organisms do not have the same parts as their multicellular relatives.

POWER'S MICROSCOPICAL OBSERVATIONS ON ANIMALS AND PLANTS

The first section of *Microscopical Observations* consists of 50 numbered observations, most of which are on biological material, and was complete by 1661. As is apparent from the quotations from its preface, he used capital letters inconsistently and his spelling was capricious. Quotations are given verbatim.

Observation 1 is entitled 'Of the Flea'. As in subsequent observations, where this is sometimes even more apparent, use of the indefinite article would be more appropriate, but we can be reasonably certain that the species concerned is *Pulex irritans* which specialises in biting man. Power may have been acquainted only with this species, but others, such as the Dog Flea, *Ctenocephalus canis,* could have come to his attention. According to Richards and Davies (1997) nearly 1,400 species of fleas have been described, of which 53 are known in the British Isles. As in several subsequent descriptions he attempts to convey some impression of the magnifying power of his microscope by a comparison, saying "It seems as big as a little prawn or shrimp", which of course is no guide to actual size or degree of magnification.

Not unnaturally he refers to the ocelli as eyes (fleas lack compound eyes), and notes its "shining and polished" "blackish armour". He then reveals his interest not merely in structures but in their function when he refers to the "great leaps" of which it is capable and the "advantageous contrivance of the joynts of his hinder legs, which bend backwards

* It had been thought that the stars were stuck to a series of concentric transparent spheres.

towards the belly, and the knees or flexure of his fore-legs forwards…that he might thereby take a better rise when he leaps". He also notes that "His feet are split into claws or talons, that he might the better stick to what he lights upon: he hath also two pointers before which grow out of the forehead, by which he tryes and feels all objects whether they be edible or no". The latter are the maxillary palps. While the structure (and function) of the mouthparts are more complex than he appreciated, he was aware that, in essence, they make up "a Proboscis, or hollow trunk or probe, by which he both punches the skin and sucks the blood through it, leaving that central spot in the middle of the Flea-biting, where the probe entred".

He rounds off his account by marvelling at the strength of fleas which, even before his time, had been exploited for amusement, and refers to an account by Muffet of a flea that had not only pulled a gold chain "but a golden Charriot also with all its harness and accoutrements fixed to it". One wonders when this practice arose and how fleas were attached to what they pulled. Presumably a simple lens was used to facilitate the task. The Muffet (Moffet, or Mouffet) to whom he refers was Thomas Muffet (1553-1604) whose book *Insectorum Theatrum,* written largely by others, appeared posthumously and after many vicissitudes in 1634. An English translation appeared in 1658, and in 1664 was still the only book on insects published in England. Power's praiseworthy description of a flea has long been overshadowed by that of Hooke, published in 1665, which is accompanied by a magnificent and justly famous drawing which he was clearly unable to emulate and whose lack often makes it difficult for readers of his descriptions to visualise unfamiliar organisms.

Observations 2 to 5 deal with "The Bee", "The Common Fly", "The Gray, or Horse-Fly" and "The Butter-Fly". While each deserves individual mention, a feature common to all is that special attention is drawn to the compound eye, the nature of which was revealed by the microscope in a way hitherto inconceivable. Power reports that "The eye of a Bee…is all foraminulous, drill'd full of innumerable holes like a Grater or Thimble; and, which is the more wonderful, we could plainly see, that the holes were all, of a square figure, like an honey-comb, and stuck full of small hairs (like the pores in our skin) and which (by blowing upon) you might see waft too and fro; all of which neat particularities were more palpably discovered in the eye of a great Humble-Bee". This description of a compound eye was criticised by Hooke (1665) in the Preface of his *Micrographia* where he noted that the eyes "of a Fly in one kind of light appeared almost like a Lattice, drill'd through with abundance of small holes: which probably may be the Reason why the Ingenious Dr Power seems to suppose them such." However, in his description of none of these insects did Power say that the eyes were "drill'd through" with holes as Hooke claimed he did. Indeed of the Humble-Bee he said they were "drill'd full" and went on to say "now these holes were not absolute perforations, but only dimples in their crustaceous *Tunica cornea*, which it seems is full of little pit holes like the cap of a thimble", and in describing the eye of a House Fly, *Musca domestica*, (his "Common Fly") he noted that it was "most neatly dimpled with innumerable little cavities like a small grater or thimble, through which *seeming perforations* (my italics) you may see a faint reddish colour."

Indeed Power "cutt out the eye" of a large Humble Bee and of a "Crecket" (cricket) and "bared the shell or horney coat of the eye; [that is the transparent cornea] and laying either the convex or concave side upwards…could easily perceive the little holes or dimples formerly mentioned". This was one of the first attempts to ascertain the structure of a compound eye, and of course revealed none of the details of the ommatidia of which it is now know to be largely composed. As a pioneer, however, he had been forestalled by Hodierna (1644) who studied the eyes of a wide range of insects and gave what, for an early endeavour, was a remarkable account of the eye of a fly, though Power had not seen this. Moreover Hodierna gave an excellent illustration and, by bisecting the eye of a fly, revealed at least something of its internal arrangements. Power also extended his observations to the eye of the "Gray or Horse Fly" which he described as "indented all over with pure Emerauld–Green … and all latticed or chequered with dimples like the Common

Flyes, which makes the indentures look more pleasantly". This clearly refers to a tabanid of the genus *Haematopota,* commonly called a 'cleg', the description of whose eyes shows that he did not think they were perforated by holes. In his description of the "Common Fly" – the House Fly, *Musca domestica* – he notes that all flies have what we now call compound eyes and says that they are more conspicuous in "Carnivorous or Flesh-Flyes" and in the "Stercorary or Yellow Flyes that feed upon Cow-dung". He then goes on to say that such eyes are found in "divers other Insects" of which he enumerates "the Shepherd - flye or Spinster -Flye", *Cantharides* or French Flies, also in all sorts of Scarabees [beetles]...in all sorts of Moth -flyes, called by *Muffet, Phalaenae papiliones* [moths] also in the May-fly, Butter-flyes, Scorpion-tail'd fly, Twinges and Earwigs; most clearly in the sloe-black eye of the Crecket, and in the large eye of the Dragonfly or Adderbolt". This list shows that he was familiar with a diversity of insects, but was of course unable to refer to them by scientific names as binomial nomenclature for animals was not to be introduced until almost a century later.

He recorded that "The stings in all Bees are hollow and tubulous (like a Shoemaker's-punch) so that when they prick the flesh, they do also, through that channel, transfuse the poyson into it: For if you take a Bee, Wasp, Or Humble-Bee especially, and gently squeeze her tayle, so that you may see the sting, you shall perceive a drop of diaphanous liquor at the very end of it, which if you wipe off, you shall distinctly see it renewed again, that humour passing down the Cavity into the end thereof".

Probably reflecting his medical background, Power was interested in the heart and circulation and reported that one can see the heart beating in "the Bee (or Humble-Bee especially) near the neck", and that, after cutting off the head of a Horse Fly one can see "a pulsating particle (which certainly is the heart) to beat for half an hour" thereafter. In fact what he saw was the anterior end of the dorsal aorta or vessel whose muscular 'pump' is located more posteriorly. His error is understandable. Ironically, however, at the outset of his medical career he had sought advice on his studies from Thomas Browne, and from the latter's correspondence we know that in 1646 he sent a list of books to the young Power that he recommended for study. Among these was William Harvey's great work on the circulation of the blood, *De motu cordis* (1628), to which he drew particular attention. During his investigation of this problem Harvey studied a wide range of animals and, in chapter 17 of the resulting book, actually noted that it is a locally dilated blood vessel, and not a heart that pulsates "in hornets and bees and other insects" (Franklin's transl. 1957). Power evidently did not remember this! Harvey used a hand lens to elucidate these facts. That the circulation of the blood in animals was not established until within Power's lifetime is another vivid reminder of the rudimentary state of knowledge of living organisms at that time, and helps to put his findings in context. It is even more salutary to remember that Harvey himself never appreciated that the blood underwent any essential change in the lungs of vertebrates, and thought that it might be cooled there.

Power was intrigued by the well known ability of the "Common Fly" to alight on, and walk beneath, a surface such as a ceiling, "with her back downwards and perpendicularly invers'd to the Horizon". While he notes that the extremities of the legs are provided with claws "by which she layes hold of the rugosities and asperities of all bodies she walks over," he goes on to say that "the wisdom of Nature has indued her with another singular Artifice, and that is a fuzzy kinde of substance like little sponges, with which she hath lined the soles of her feet, which substance is always repleated with a whitish viscous liquor, which she can at pleasure squeeze out and so sodder or be-glew herself to the plain she walks on, which otherwise her gravity would hinder (were it not for this contrivance) especially when she walks in those inverted positions". This attempt to explain an extremely complex phenomenon, which has both structural and behavioural elements, was, however, incorrect. Hooke, who also considered the problem in his *Micrographia*, first established that flies cannot "stick or suspend themselves on the under surface of a Glass well polished and cleans'd," from which he deduced that "their suspension therefore is wholly to be ascribed to some mechanical contrivance in their feet". Of this, by reference

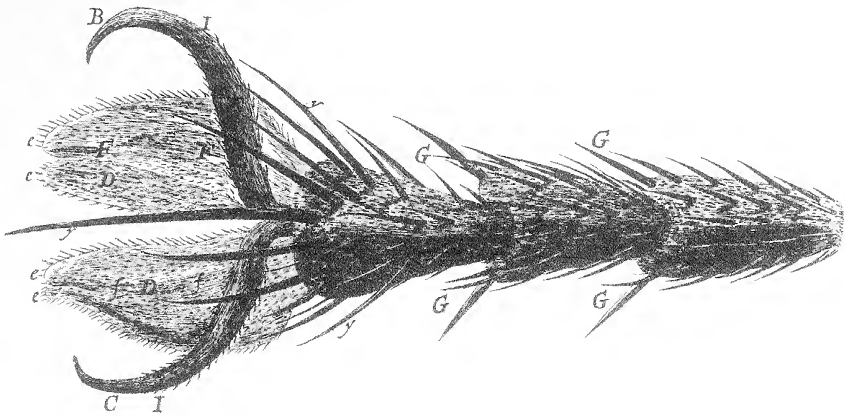


FIGURE 1.
"The foot of a Fly", drawn by Hooke (1665). The two flattened distal lobes that he called "Palms, Pattens, or Soles", which are referred to by the last of these names by Power, are the pulvilli. In relation to the surface on which the fly settles, they lie below, and in no way interfere with the action of, the two curved distal claws. This example makes apparent the immediate and immense increase in comprehension that illustrations conferred on Hooke's descriptions of unfamiliar objects, when compared with Power's un-illustrated reports; for example, the reader can easily follow his account of how the spines on the subsections of the tarsus, labelled G, contribute to attachment of the limb to the substratum. Without an illustration this would be almost impossible.

to excellent illustrations, of which one is here reproduced as Figure 1, he gave a splendid explanation of how "the Fly suspends itself very firmly and easily, without the access of any such Sponges filled with an imaginary *gluten*, as many have, for want of good Glasses, perhaps, or a troublesome and diligent examination supposed". He then tells us that he surveyed the structures concerned "somewhat the more diligently...because I could not well comprehend, how, if there were such a gelatinous matter in those supposed sponges...how, I say, the Fly could so readily unglew and loosen its feet". Having demolished this misconception, he goes on to a discourse on the mechanics of arthropod locomotion in relation to size, structure and habits that is on a higher plane than Power or, probably any person then living, could have given. Ironically there may almost have been an element of truth in Power's explanation in that surfaces such as those of the pulvilli that, in insects that cling or climb, come into contact with the substratum, are often covered with dense arrays of minute tubular spinules, called tenent hairs, whose pointed tips are moistened by glandular secretions. The mechanism by which these assist attachment has been controversial, but the tenent hairs can be so closely applied to a surface that, in the presence of a minute amount of fluid, surface molecular forces can operate.

The efficacy of such forces is graphically demonstrated by the discovery that the similarly long puzzling ability of geckos (lizards of the family Geckonidae) to perform the same feat as the House Fly to walk, and indeed to run swiftly, beneath a ceiling, depends on a similar device. Scanning electron microscopy reveals that the toes of their feet are crossed by transverse ridges which bear projections that in turn bear spatulate-tipped nanohairs, of which there are several million per toe. These are the equivalents of the tenent hairs of the House Fly and other climbing insects, and similar molecular forces operate. This is a remarkable example of convergent evolution involving groups of animals

that are phylogenetically extremely divergent. It also demonstrates the remarkable efficiency of the mechanism. Geckos are, of course, vastly heavier than flies.

Inventions such as high speed cine-photography and stroboscopes have now enabled the manner in which a fly alights upside down on a ceiling to be elucidated. A House Fly can even attach itself beneath a glass plate that has presumably not been excessively "polished and cleans'd" as meticulously as by Hooke. Pioneering observations by Curran (1948) and the photographer H. M. Lester on hover flies, subsequent work on the House Fly by Curran (1958) and the photographer D. Hollis, and the detailed work of Hyzer (1962), revealed that a House Fly approaches a ceiling on a flight path at an acute angle to the vertical at c. 25cm/sec. (c. 900m / h). As it can achieve speeds of more than 6 km/h in sustained flight, for obvious reasons it makes its approach at a low speed. During this phase of the approach the anterior legs are extended upward (above the dorsal side) and obliquely forward at each side of the head (Figure 2a), and the wings beat at between 144 and 240 cycles /sec. A large supination twist of the wings at the beginning and end of the down-stroke provide the required thrust for near-vertical climbing. When the fly approaches within about a body length of the ceiling it extends the two posterior pairs of legs outward, and swings the anterior pair ventrally so that they are directed forward and towards the ceiling. Having been brought closer together, these make contact (2b) and serve, first as shock absorbers, then as anchors which grasp the ceiling with their claws as their pulvilli begin to function as attachment organs, and the wings cease to beat. The body still has forward momentum and rotates about the forelegs, swinging the ventral side of the fly towards the ceiling, so that the second and third pairs of legs are brought into contact with it (2c). Independent fluttering of the wings stabilises the body during this manoeuvre; all twelve pulvilli, and all the claws, can then operate. The fly thereby achieves its objective

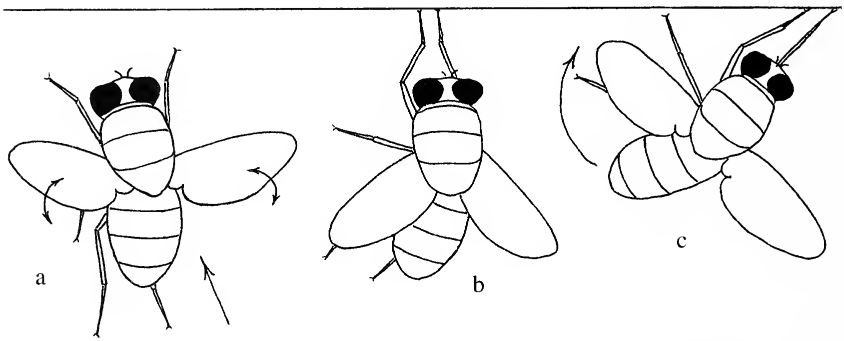


FIGURE 2.

How a fly alights on a ceiling. (Based on Hyzer 1962) In (a) the anterior legs are shown in a position that conforms more accurately with that shown in photographs in Curran (1958) than is depicted in Hyzer's illustrations. The fly begins to extend its legs when it is somewhat further from the ceiling than shown at (a), where its position is dictated partly by convenience. That some 300 years were to elapse between the time that Power (and Hooke) considered how a fly could alight on, and walk inverted beneath, a ceiling, and it became possible to demonstrate, and, as here, illustrate, how this is achieved, puts into perspective the magnitude of the problem they attempted to solve. Both these early investigators appreciated the mechanical significance of the claws, and Hooke, who demonstrated that the idea that a i.e. 'glue' was employed in the way suggested by Power, was incorrect, showed that mechanical contrivances alone were involved. Nachtigall (1974), who apparently confirmed Hyzer's observations, used a stroboscope operating at 1,000 flashes per second, and the exposure time of the film for a single image was a millionth of a second.

without ever having to fly upside down. There is no half-roll, as some theorists had suggested might be the means whereby the fly alights inverted. These events cannot be analysed by the naked eye. A fly can walk inverted because three of the legs remain in contact with the surface as it does so.

Power errs on a simpler point of observation on the House Fly when he says that, as well as using the first pair of legs to "wipe her mouth and nose"! it does so "to take up any thing to eat". He is more successful in his account of butterflies in which he waxes lyrical about "the variegated diversity of colours in her expanded wings" and goes on to say "But view them in the *Microscope* and you may see the very streaks of the Coelestial pencil that drew them". He likens the wings to "a great plume of feathers" and records that the "small meal and dust...(which sticks to your fingers when you catch them) is all small little feathers, which grow out of their wings; and you may plainly see the twills by which they stick to the wings, and the holes [that is the sockets] out of which they are pluck'd". This is an excellent terse description of the wing scales, whose accuracy can be verified by a glance at photographs made by scanning electron microscopy in recent years. His statement that "Nature having imp'd her wings (for her better flight) with these plumeous excrescences" is clearly not to be taken as likening these minute scales functionally to the much larger feathers of birds, as is confirmed when he goes on to say that their nature "shews how vastly they were mistaken, that held their mealy dust to be an exhalation of atoms from the wings". It is easy to forget what significant steps in our knowledge were made by early investigators, and Power deserves an honourable mention in entomology for these observations. He also commented on the coiled proboscis "which supplies the office of both Mouth and Tongue" and "seems to be hollow...and to have a transparent kinde of hollownesse quite throughout".

Like his observations on a flea, his next, on "A Louse" (ie. a Body Louse (Siphunculata), *Pediculus humanus*) are overshadowed by the beautifully illustrated account of the same insect by Hooke, which appeared in 1665. To anyone unfamiliar with a louse it would be difficult to visualise its general morphology from Power's description, but in those days he no doubt assumed that his readers would be familiar with this pest, which he describes as "very handsome to behold". As Hooke remarked, "twill be known to everyone at one time or other, so busie, and so impudent, that it will be intruding itself in every ones company". While Hooke had no need to copy from Power, whose account is brief, he was probably subconsciously influenced by it. Power describes its eyes as "goggled and protuberant" while Hooke refers to its "shining goggle eyes". The use of the same uncommon adjective by both authors seems unlikely to be fortuitous,

What in Observation 7 Power calls "A Wood-Louse or Wood Mite" is in modern terminology a book louse (Psocoptera) of which he gives a brief, competent description and, as anyone who has ever done so can confirm, notes that "you may kill it with a very little touch of your finger". As an example of the need for scientific nomenclature the confusing medley of common names involved could hardly be bettered, not least because in modern parlance the name 'Wood-louse' is applied to a group of crustaceans!

Observations 8 to 11 deal with spiders and harvestmen. Under "The House Spider" Power himself indicates that more than one species is embraced by this name and says that they include one with "longer legs and a little body and the other contrariwise" and that some have four (which is incorrect), others six, and others eight eyes. They presumably included *Tegenaria domestica.* He describes the eyes as set on the front of the head and being "all diaphanous and transparent like a Locket of Diamonds, or a Sett of round Crystal Beads" and makes two excellent suggestions to explain why they have more than a single pair. "For, first: since they wanting a neck cannot move their head, it is requisite that defect should be supplied by the multiplicity of eyes. Secondly: Since they were to live by catching so nimble a prey as a Fly is, they ought to see her every way, and to take her *per saltum* (as they do) without any motion of their head to discover her; which motion would have scared away so timorous an Insect." The second point in particular suggests that he included jumping spiders (Salticidae) in his observations. His remark that the legs are "split

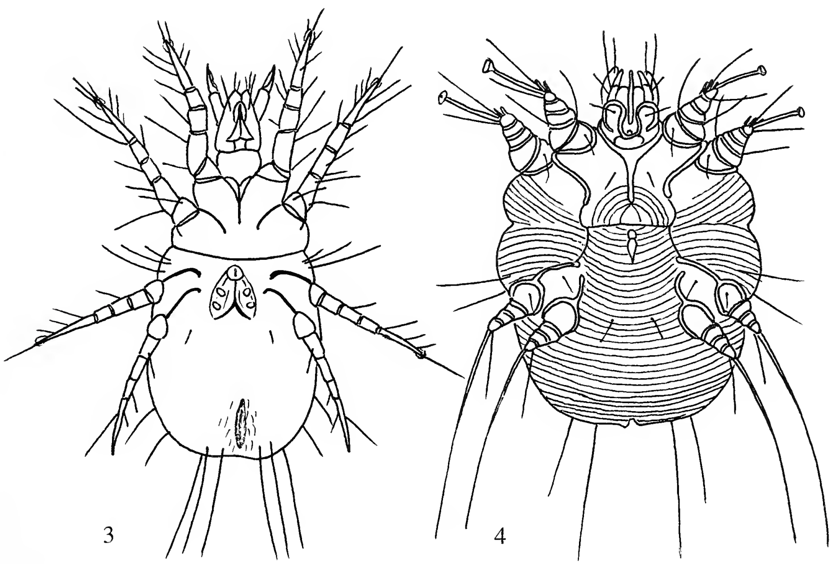
into small oblong fingers at the ends, by which she makes her curious webwork" implies that he was unaware that the silk emanates from spinnerets. Likewise, Observation 9 on "the little white Field-Spider with short legs" and a diagram showing two arrangements of eyes, one involving 6, the other 8 (one of the very few in this section of his book) again indicates that his description embraces more than one species. Noteworthy is the fact that, having described the colour of an eye, he adds "but not perforated at all" by which he implies that they do not show the reticulated pattern of compound eyes, which are not found in spiders – which remains an awkward anomaly for the claim that arthropods are monophyletic. He included harvestmen (Opiliones) among spiders, and noted their elevated "but not foraminulous eyes".

The superficiality of Power's treatment of spiders and their allies, and his inability to give them meaningful names, is put into perspective when it is realised that his only predecessors in England who had concerned themselves with arachnids were essentially medieval in outlook. Even when, in 1678, after much study, Martin Lister, then living in York, wrote his monograph on English spiders and molluscs (*Historiae Animalium Angliae Tres Tractatus*) he listed our arachnid fauna as consisting of only 34 spiders, 3 harvestmen, and one mite. Moreover, in his preface he wrote that "it is not easy to find in this island any new species that I have failed to describe" [transl.] – though Willughby believed there were perhaps twice that number. Well over 600 species of spiders have now been recorded from Britain. Furthermore, Lister did not give names to his spiders. He produced a plate on which all were illustrated, and each species was given a number, by reference to which he listed and described them. He was also unaware of some of the things that now seem obvious; for example, he believed that spiders produce their silk through the anus. None of this detracts from the great advances in our understanding of spiders made by Lister, an astute observer who learned much about such things as the manner of their web spinning, means of dispersal, and other aspects of their biology. Power's very limited knowledge of the group before Lister produced his monograph is therefore not surprising.

Observations 12 to 15 are on mites found in cheese, malt dust and oatmeal dust, figs, and "Jujubes and Sebestens" (exotic fruits) respectively. Besides describing their form and motion, Power marvels at their minute size, referring to cheese mites, which belong to the genus *Tyroglyphus* (Fig. 3), as "moving Atoms". Large females of *T. siro* (= *Acarus siro*) achieve a length of 0.7mm, of *T. longior* c. 0.75mm, but are often smaller. Males are smaller. Here he was dealing with truly microscopic animals. He was never to become acquainted with the often much smaller protozoans. He could have seen either or both these species of *Tyroglyphus,* both of which frequent decaying cheese but are not confined to this medium. Other members of the family Tyroglyphidae, whose British representatives were first monographed with numerous illustrations by Michael (1901, 1903), frequent a diversity of habitats where they are sometimes exceedingly abundant. Power emphasises the minuscule size of the "hairs which grow out of their leggs, which leggs themselves are smaller than the smallest hair our eyes can discover". He goes on to rhapsodise about the "prodigious skilfulness of Nature In the fabrick of such Minute an Animal", smaller than a seed of Tobacco, and reflects on "how many thousand parts of Matter must go to make up this heterogeneous Contexture? For, besides the parts inservient to Nutrition, Sensation, and Motion, how small and thin must the liquors be that circulate through the pipes and vessels disseminated through those parts? Nay, How incomprehensibly subtil must the Animal spirits be that can run too and fro in Nerves included in such prodigiously little spindle-shanked leggs?" One can still marvel in this way today, but Power was of course unaware that, being arthropods, mites have no 'pipes' that circulate fluids, but have an open blood system in which organs are bathed in blood which circulates in the haemocoele. Indeed such minute, slow moving creatures do not need a complex circulatory system, and circulation is in fact extremely degenerate.

Power discovered tiny mites in other situations as well as among cheese, and was one of the first to begin to make known the diversity and abundance of these minute arachnids. He recognised that those he found among malt and oatmeal dust were different from those

he saw on cheese and that they were "more active and quicker in motions." He may have seen more than one species here because some were bigger, others smaller, than cheese mites. He describes how they move among oatmeal, "running and scudding amongst it; under it, over it, and into it like Rabbits into their Burrows: and sometimes casting it up (as Moles or Pioners do earth)". It is difficult to know how many species he saw in the course of his investigations, but he certainly encountered several; for example, in the "brownish kind of powder" which falls from "Jejubs and Sebesten's, being long kept" he found "small whitish mites, very little ones, and all beset with bristles and hairs round over like a Hedgehog, but not so quick and lively in motion as the other Mites". He appears to have seen a different species among figs, and here he may have recognised immature stages for of some of these he says "you may clearly see three leggs on either side of the body". Adults have four pairs, but one cannot be certain that what he referred to as two very long "horns" near the snout were not legs. He also explored other habitats and found mites in hay and in "the powder that falls from dryed roots". It is probable that among the species that he saw were either *Glycyphagus domesticus* or *G. spinipes*, or both, which are very common in diverse situations and are great destroyers of dried animal and vegetable matter.



FIGURES 3 & 4. Two minute mites observed by Henry Power.
3. A cheese mite, *Tyroglyphus siro,* female, ventral, a frequenter of decaying cheese. Length to c. 0.7 mm. (Partly after a 19th century illustration of Leuckart and Nitsche.) He must have seen either this species or *T. longior,* or both. 4. The Itch Mite, *Sarcoptes scabiei,* female, ventral. Length less than 0.5 mm. This mite burrows into human skin and causes intense itching. (Redrawn from a 19th century illustration of Leuckart.)

He made a very interesting observation (number 11) when, without realising it, he saw mites in an egg sac being carried by a spider. Inside the sac were eggs and also "an abundance of very minute spiders, newly hatch'd, no bigger, and just like Mites in Meal, with white hair and bristles especially in their tail, creeping and crawling amongst the eggs". These were clearly mites. Spiders conspicuously lack what he called "hairs and

bristles" on the posterior margin of their opisthosome or 'tail'. That what he saw were mites he unwittingly confirmed when he examined "a bag full of House-Spider-eggs" which were "either hatching or just hatch'd." Here the "youngling Spiders...were far bigger than the former...and shap'd like the Parent with five legs on each side [he obviously included the pedipalps as legs]...and not by far so active as the other".

He also saw mites associated with other animals. The heading of Observation 16 "The Red Mite found on Spiders" is initially confusing because, although many insects, including even short-lived adults of butterflies, are used as hosts by mites, adult spiders are singularly free from their attention. Power's statement "There is a red Mite, which you shall find often feeding upon Spiders" is therefore puzzling until it is appreciated that he included harvestmen (Opiliones) among spiders, and that "the Field Spider" to which he here refers is a harvestman which he describes as "The Field Spider with Long Legs" in Observation 10. He describes the mite concerned as "bodied just like a Tortoise, with a little head and six long small leggs, three on each side". Adult mites have four pairs, and those that he saw were indeed hexapod larvae of trombiids which occur commonly on harvestmen. He records how "About the leggs of the Field-Spider I have found many of these Coral-Mites or Tortoises, and this thing I have observed of them, That they cling exceeding close to the Animal whilst she is alive; but when dead they all fall off and creep away from her, as lice do from dying men".

He also records (Observation 17) that "Within the yellowish plush or furre of Humble-Bees you shall often find a little whitish very nimbly-running Animal which hath the shape and form of a Mite in the *Microscope*". He then refers to Kirchner as having "found by his Glasses Lice upon Fleas" and goes on to say that "Either our Fleas in *England* are not like theirs in *Italy* for this property, or else I have never taken them in their Lousie season: But I see no reason to the contrary, but both Fleas and Lice may have other Lice that feed upon them, as they do upon us". The reference to Kirchner is to Athenasius Kirchner, (1602-1680) a member of a Jesuit college in Italy, best known for his illustrated books. These, however, are often fanciful and virtually useless as contributions to science. As long ago as 1667 Martin Lister criticised him for his belief in spontaneous generation and as a false interpreter of Aristotle (who was not always right!) and Dobell (1932) refers to him as "a voluminous and reckless writer on all manner of subjects," as the "veriest dabbler in science," whose writings are "unscientific in the highest degree", and some of whose experiments were "too ridiculous to quote". Although Power did not question his claim, he was unable to confirm it. He does not enlarge on his own finding of mites on bees, which he appears to have been the first to report, but merely makes an obscure comment on them. Bees are now known to serve as hosts to several species of mites, some of which, like those that he saw, live externally and do little harm, but others can seriously affect the well-being of their host or even cause its death. *Veroa destructor*, introduced in Europe from the Asian bee *Apis cerana* in the late 1970s, and subsequently found in Britain, is now a serious pest of hive bees here. Other minute mites that enter the tracheal system of bees sometimes kill their host. Yet others live in mutualistic association with bees and wasps, some of which have even evolved pocket-like structures called acarinaria in which tiny mites can be carried. One such mite, *Ensliniella parasitica*, frequents the acarinaria of the wasp *Allodynerus delphinalis*, is carried into its host's nest, and there protects pupal and prepupal stages against the hymenopteran parasitoid *Melittobia acasta* when it attempts to lay eggs on them. The mites's reward is to feed on the host's haemolymph, which it does without killing it. The parasitoid kills it. (Okabe & Makino, 2008).

When to his reports one adds those on the Itch Mite (see below), it is apparent that, although he was familiar with only a few species, Power was undoubtedly one of the first to draw attention to the existence, diversity and abundance of mites, of which some 30,000 species are now known and a probably much greater number remain to be described. Those that he saw probably included oribatids, also monographed by Michael (1884, 1885), that are more speciose than tyroglyphids, occur in vast numbers in a variety of habitats, and include many commensal and parasitic species. Serious study of mites as a group did not

begin until the 1830s when Dugès, Koch and their successors began to reveal their diversity. Even then Koch's work, while meritorious, was haphazard and unsystematic.

Observation 18, entitled 'Pond Mites', and the speculation it inspired, are in several ways among the most interesting of those made. It begins with the statement that "There are bred in most restagnant Waters, Pools and Fishponds, in *June* and *July*, an innumerable company of little whitish Animals, which move up and down in the water with jerks and stops in their motion; in which Animals we could discover two little horns and leggs, but could never get to see it quick in the *Microscope* : for as soon as ever it is taken out of the water, it is perfectly dead". As recently noted (Fryer 2008), while it is not certain to which animals this description applied – though it was certainly not to mites – it describes very neatly the behaviour of some pond-frequenting species of the branchiopod crustacean *Daphnia*, and it is only because one cannot with certainty rule out the possibility that what he saw were cyclopoid copepods that it cannot be claimed that this is the earliest reference ever made to *Daphnia.* If, though this seems less likely, the animals were indeed cyclopoid copepods, this appears to be the first reference to that group of crustaceans, but could refer to a member of any one of what are now regarded as several different genera. The "two little horns" almost certainly refer to the conspicuous antennae by means of which *Daphnia* propels itself through the water in the jerky manner that Power describes, and it is much less likely that he would have detected the outstretched antennules of a cyclopoid copepod which, unlike the rigid antennae of *Daphnia*, fold and become difficult to see when the animal is taken from the water. The legs to which he refers could have been the small exposed legs of a copepod or those enclosed within the carapace of *Daphnia*, but it is pointless to guess. Neither would be easy to see in an individual removed from the water. It is ironical that these animals are relatively easy to observe by transmitted light if placed in a drop of water on a glass slide, but this facility was clearly not available to Power whose microscope was designed to use reflected light.

Having commented on the fact that the sea also "swarms with Maggots and Grubs," he goes on to make a remarkable statement, "Nay, not onely the Water, but the very Air itself, may certainly at some times and seasons be full of living creatures; which must be, most probably, when great putrefactions reign therein, as in the Plague-time especially", and cites personal experiences. "Now, it were well worth the Observation if in such aerial Putrefactions any kind of living creatures could be discovered, which probably may be done by Glasses: for I am sure in my long *Telescope* I can some days see a tremulous Motion and Agitation of rowling fumes, and strong Atoms in the air, which I cannot see of other days; of which I shall perchance more largely discourse in my *Telescopical* Observations."

Here, it is not too fanciful to claim, we have an anticipation of the germ theory of disease more than two centuries before it was established against – much resistance from the medical profession. Power was bringing together in his mind his experiences as a microscopist (and telescope user), and his knowledge of medicine. This is all the more remarkable because neither did his own microscopical investigations extend to truly minute organisms, nor had Antoni van Leeuwenhoek yet revealed the existence of protozoans and bacteria, some of which were indeed eventually shown to be the causative organisms of certain diseases, just as Power envisaged may be the case. Indeed, not only did he postulate their existence, he predicted that their discovery "may probably be done by Glasses". One has however to be cautious. As Dobell (1932) points out, there have been suggestions in the past that a living contagion or infective agent floating invisibly in the air is responsible for diseases, especially at times of epidemics, and the idea of 'miasmas' emanating from swampy places was long ago linked to malaria. The name means 'bad air'. Dobell draws particular attention to Girolama Fracastoro (c. 1483-1553) whose postulated 'seminaria' can be likened to bacteria – but are entirely hypothetical. Power's suggestion is more compelling than these, in that he not only drew a hypothetical connection between the presence of 'living creatures' in the air and plagues, but did so by analogy with what he knew to be the existence of such in water, though, ironically, he had not discovered there

the truly minute world of protozoans and bacteria – some of which *are* such agents. Added to this he argued from what he had actually seen in his telescope - even though he misinterpreted this. While he was misled by the latter, his putting together of factual observations and what he believed he had seen, and linking these things to the occurrence of plagues, was a legitimate hypothesis of considerable interest. One wonders however, whether, in making this suggestion he was influenced, and at least partially forestalled, by Borel (1656), for he too suggested that minute insects in the air might be the source of plague.

The animal referred to in Observation 19 by four alternative vernacular names – Whey-worms, Wheal-worms, Hand-worms, and Barrows – is the Itch-mite, *Sarcoptes scabiei* (Fig. 4). Because it inflicts itself on humans, into whose skin it burrows, and where females make tunnels up to c. 2 cm in length, this minute mite, or at least its all too obvious effects on its host, have long been known. Although now relatively easily cured, infections – which nevertheless closed a hospital ward in Glasgow in 2008 – can spread widely over the body, cause intense itching and irritation, and be very painful. Just when the cause of the affliction was first recognised as an animal and when *Sarcoptes* was first identified as such is unclear. While it is possible to dig it out of its burrow with a fine needle, as it is less than half a millimetre in length little can be made out of its structure by the naked eye. Nevertheless, the variety of vernacular names which suggest that it is some kind of 'worm' indicate that its animal nature was long appreciated, or at least suspected. There is nothing worm-like about its structure. Its true affinities appear to have been recognised before Muffet's *Insectorum Theatrum* was posthumously published in 1634. Referring to the preface of that work, Power notes that "Our famous *Mayhern* [Sir Touquet de Mayerne (1573-1655) who was responsible for getting the volume published] (who had the advantage of an Ordinary *Microscope*)", that is a hand lens, gave a "short, but very neat description of this poor Animal". This in fact said little more than that it had a red head and possessed feet (legs). Muffet himself recognised that it made burrows or mines in the skin and was the cause of intense itching, but appears to have thought it had no 'feet'. As Power put it, "These smallest of creatures (being accounted by *Muffet* as a Species and kind of Mites, bred upon Animals as the former sort are in Cheese, Meal, Wax, rotten Wood &c) may very well be the subject of our next Observation".

His description is very good. "In this small Animal you may see an oval reddish head, and therein a mouth or prominent snout, arm'd with an Appendent Proboscis or Trunk, consisting of many villous filaments in figure of a Cone, wherewith it perforates our skin and sucks the blood or Aqueous nutriment from the pustules it is bred near. Nay, you may discover feet, laterally ranged on both sides, and many hairy tufts on the tayl, with asperities, rugosities, and protuberances on the skin. To behold all which varieties of parts and organs in so minute a particle of Matter (as this living Atom is) I know not whether it be more admirable to behold or incredible to believe without an Ocular Demonstration." He then goes on to say "Certainly *Scaliger* and *Muffet* would have far more admired this almost invisible sub-cutaneous Inhabitant, had they the happiness to have seen it in our *Microscope*".

It is only fair to note that Walter Charleton (1654) had given an account of the structure of the Itch-mite (which he called a Handworm) aided by "a good Engyoscope", that is a microscope, to which that of Power has similarities in wording, that may have aided him in his description. Others too were attracted to the Itch-mite at about this time, and August Hauptmann (1657) gave an extremely crude, virtually unrecognizable, illustration of it just before Power described it. Other illustrations, some tolerably accurate others grotesque, appeared before the end of the century, but subsequent to his description.

As the morphology of the animal is now well known, an illustration, based on a 19th century drawing by Leuckhart, is included to give meaning to Power's account (Fig. 4). It also confirms the general accuracy of his description. We know from a surviving Memorandum book compiled by Power and examined by Clay (1917) that the former encountered sufferers afflicted by this mite among his own patients. Affluence was no

insurance against infection. In 1653 he recorded that the daughter of Squire Rookes of Royds Hall was suffering from "scabies salimosa, cum tumore pedum" – scabies with swelling of the feet – and in 1655 the 11 year old Susanna Horton of Barkisland Hall was plagued by "scabies salimosa totius corporis" – scabies over her whole body – which must have been excruciatingly painful. It is ironical that one of the earliest records of a specifically identified invertebrate in Yorkshire, in 1653, should be of the microscopic mite *Sarcoptes scabiei* ! Several species closely related to *S. scabiei* (sometimes described as 'varieties'!) parasitize domestic and other animals and can penetrate the human skin, but cannot complete their life cycle there.

Observation 20 is on the Glow-worm, "that Night-Animal with its Lanthorn in its tail, that creeping star" of which the eyes come in for comment; and 21 is on "Common Grasshoppers," the cornea of whose eye he examined and whose pulsating dorsal aorta is noted. Observation 22, on "The Ant, Emmet or Pismire," has little to do with microscopy, but he comments on its strength and on how ants "carry their white oblong eggs" which of course refers to their pupae and reminds us how little was known about the habits and life histories even of common insects in the 17th century. His mistake, what his mentor Thomas Browne would have called a vulgar error, is of course still prevalent today.

Observations 23 and 24 are on aphids, of which the first is described as "a little greenish Grasshopper or Locust bred upon the backside of green leaves, especially the leaves of Gooseberries, Sweet-briar and Golden Mousear, in April and beginning of May". They call for no particular comment.

The next, "Of Cuckoo-Spitt, and the little Insect bred therein, in May", involves little microscopy but is enlightening in revealing how little was known about even common insects three and a half centuries ago. The insect concerned is probably the common *Philaenus spumarius* (Hemiptera : Homoptera). Power describes how, within the spittle "you shall always find a little Grub or Animal" which he briefly describes, and says that, according to Muffet, "first it creepeth, then leapeth, and at last flyeth". He could "discover no mouth at all, but a long reddish Probe … through which, perchance she suck'd her froathy nourishment". The froth is of course produced by the insect. His bewilderment appears to have been complete when he concedes that "what this spumaceous matter is, and into what Animal this Insect is at last shaped or transpeciated, are Doubts that as yet have found no clear or experimental Decision. That the Spittle is a froathy kind of dew that falls from the Air, I doubt not, whatsoever my Lord *Bacon* say to the contrary", and gives what he thinks are reasons for so believing. He is also puzzled as to "How should an excrement of so many several Plants, still breed one and the same Animal, when as we see that all Vegetables whatever produce their several Insects?". That such easily remedied ignorance prevailed among educated men at that time is difficult to appreciate, and it would not be surprising if some observant countryman could have enlightened him as to the true state of affairs. What Lord Bacon said I have not discovered. Perhaps he gave the correct interpretation.

Observations 26 to 29 are mostly brief remarks on insects, which include a Pond Skater (Hemiptera: Heteroptera) described as "The Water-Insect or Water-Spider". The Cow-Lady or Spotted Scarabee refers to a Ladybird beetle in which he records that "If you unsheath her body, and take off her spotted short crustaceous wings [the elytra] you shall find under them another pair of filmy Tiffany long wings, like those of Flyes, which lie folded up, and cased within the former, of both which pair she makes use in flying" which is largely correct though only the hind wings provide motive power.

Observation 30, "Of the little white Eels or Snigs, in Vineger or Aleger", is one of the longest and most interesting of those recorded. Power describes these animals as looking "like small Silver–Eels, or little Snigs…constantly wriggling and swimming to and fro with a quick, smart and restless motion", and claimed that "for certainly of all Animals they are the least that can be seen by the bare eye". They were in fact nematodes (nematode 'worms'), which at that time had no scientific name, but were subsequently long known as *Anguillula aceti*, from their resemblance to minute eels. They are now called *Turbatrix*

aceti. Smooth, slender animals, with a long slender tail, never more than 2.3 mm long and usually much smaller (Fig. 5), they have curious ecological preferences. Apart from what has been described as a 'variety' *T. aceti dryophila,* (possibly a distinct species) which has been found on the white slime-flux of Oak trees, they have been found only in old vinegar! Here they can be very abundant. They feed on bacteria, yeasts and other fungi that grow in vessels used in old fashioned vinegar making establishments, and are commonly called Vinegar Eels. Although females with a length of 1.4 to 2.3 mm have been recorded, some races are much smaller and seldom exceed 1 mm in length. Males are smaller. Work on other small nematodes, using both molecular and morphological comparisons, has shown that a single 'morphospecies' may embrace several cryptic species. Such a situation conceivably prevails in the Vinegar Eel, which would explain the great differences in size in different populations. A species formerly included in the same genus but now assigned to *Panagrellus – P. silusiae* – has been found under damp felt beer mats in German inns! A related species, *P. redivivus,* was formerly common in the paste used by paperhangers and bookbinders.

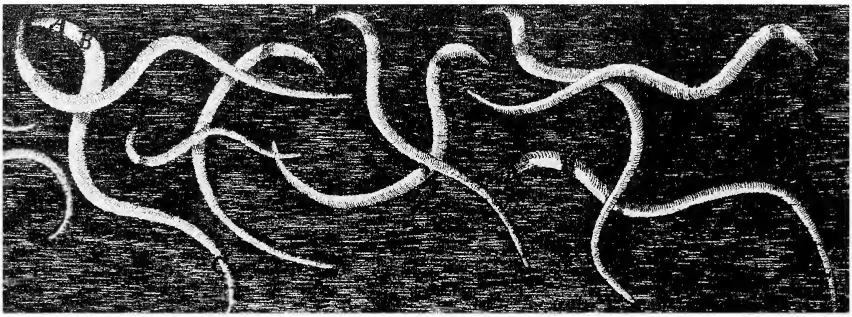


FIGURE 5.

Hooke's illustration (1665), slightly cropped, of the nematode *Turbatrix aceti* (the Vinegar Eel) which was studied by him and, in greater detail, by Power. Usually less than a millimetre in length, these unsegmented 'round worms' are frequenters of old vinegar. They propel themselves by undulations of the body in the vertical (dorso-ventral) plane. Shading is used here by Hooke as a means of indicating that the body is circular in section: it does not represent segmentation. The entire body is invested by a smooth, tough cuticle.

Turbatrix aceti can tolerate extremely high acidities and can live in acetic acid concentrations of 13.5%. In vinegar, where the concentration is usually less than 10%, it flourishes best at concentrations of 6% or less – which have a pH of 2.7 – and can tolerate a pH of 1.6. Even acid-loving freshwater animals living on acidic moorland almost never live in water as acidic as pH 3 and most of them frequent water that is much less acidic than this. In spite of its ability to live in such acidic conditions, and to survive in other organic acids, the Vinegar Eel can tolerate a pH of 11.5, which is extremely alkaline. It can also tolerate temperatures as high as 35°C, and can survive at 37°C for several days. It is probably dispersed by the Vinegar Fly, *Drosophila funebris*, and other species that frequent vinegar-making establishments. An illustration and notes on its biology are provided by Goodey (1951).

In spite of this remarkable tolerance Power discovered that "They are not to be found in all sorts of Vineger nor Aleger, but onely in such, probably, as has arrived to some peculiar temper or putrefaction, of which I can give you no Characteristical Signs; for I have found them in all sorts of Vineger, both in the keenest and smartest, as well as in the weakest and most watrish Vineger; and in all these sorts, you shall sometimes find none at all; and I have found them, and also vainly sought them, in the former Liquors, at all

seasons and times of the year also". This is perhaps the earliest attempt to define the precise ecological niche of a particular organism, and shows how difficult such an exercise can be – if indeed he was dealing with a single species!

On his Snigs, Power made various observations, noting for example that as a drop of the liquid in which they are living gradually dries up, their motion becomes feebler and when all is dried up "then they lie all dead, twisted and complicated like a knot of Eels, and after a little time dry quite away to nothing".

He found, not surprisingly, that if a spoonful of vinegar containing Vinegar Eels was heated "over a few coals", the animals were quickly killed, as they were when "a few drops of Oyle of Vitriol" were added. More interesting, he then went on to demonstrate that "although heat hath that killing property, yet it seems that cold hath not", and describes how, by "applying Snow and Salt" to a glass vessel of vinegar containing his nematodes he froze it into a mass of ice "wherein all those Animals it seemed lay incrystalled", though he was unable to see them. He thought them "gone for ever", but when, two or three hours later he melted the ice "all my little Animals made their reappearance, and danced and frisked about as lively as ever". He also "exposed a jar-glass full of this Vineger all night to a keen frost" and found that when he thawed it next morning "these little Vermin" appeared again "without any manifest injury done to them; which is both a pretty and a strange Experiment". This is probably the first demonstration of the ability of a small multicellular animal to withstand freezing, and was certainly an independent, and important, discovery. Other aquatic animals – tardigrades and certain rotifers – are now known to be able to do likewise, and the resting eggs, or specialised 'cysts' of several other groups, such as branchiopod and other crustaceans, gastrotrichs, hydroids, bryozoans and sponges also have this ability. The resistance of the Vinegar Eel has since been shown to be such that, if subjected to some preliminary desiccation, it can survive solidification in liquid air (-190°C) for 1 minute, but dies within a few hours after revival. Minute nematodes that live in mosses or lichens are much more resistant in this respect and recover completely from exposure to liquid air for 125 hours, and can tolerate even lower temperatures for shorter periods of time. Power was amazed when his Vinegar Eels survived being frozen: he would have marvelled at how resistant they and some of their relatives would prove to be. He also performed a simple experiment in a vessel with a layer of oil above the water and found that, in frosty weather, the nematodes moved "into the super-incumbent oyle to preserve themselves there".

Hooke also included observations on "the Eels in Vinegar" in his *Micrographia*, but because many "excellent ones" were "already published by the ingenious Doctor Power", confined his remarks largely to their locomotion. He also gave a drawing, reproduced here as Fig. 5, thereby bringing together the descriptions of Power and his illustration, which reveals the form of "these little Vermin" to those unfamiliar with them.

Power recorded that "Their motion is very remarkable, which is restless and constant, with perpetual undulations and wavings, like Eels or Snakes" and then adds a remark which reveals just how differently biological matters were viewed almost 350 years ago and today – "so it seems, that Animals that come nearest to the classis of Plants, have the most restless motions". It was, however, Hooke who drew attention to the fact that "the wrigling motions of their body seem'd to be onely upwards and downwards, whereas that of Eels is onely side wayes". This was a very pertinent observation, which Power took up in a manuscript annotation of a copy of his book now in the British Museum, the additions to which are listed by Hall (1966). However, Power here refers to the sideways undulation of "our Eeles, snakes and leeches". The last is an unfortunate addition as leeches undulate in the vertical plane. While beyond the scope of this essay it might be mentioned that in his account of the locomotion of the Vinegar Eel Hooke showed an awareness of the significance of their minute size, which in this respect was far in advance of its time, and is another example of his comprehensive scientific ability.

Hooke also reported that when put "in a small Viol, and stop'd very close from the ambient air, all the included Worms in a very short time died, as if they had been stifled."

Probably stimulated by this observation, Power carried out similar experiments that are recorded in his manuscript annotations where he reports that in stoppered vessels his animals died within one or two days, "so necessary is aire (it seems) to the life of even the minutest animal". It is only fair to record that both Power and Hooke were narrowly anticipated by Borel in making microscopical observations on Vinegar Eels, but it was Power who made the most significant discoveries.

Observation 31, "Of the great Black Snail," evidently refers to the slug *Arion ater*, which Power delightfully describes as "this slimy Animal (the slow–paced Engine of Nature)" in which he says there "are very many rare and excellent observables". However, his report contains gross errors. He begins by saying "That the first is his eyes, which are four in number". There are only two. Only the large posterior, or optic, tentacles bear eyes. He cut off these from the tips of the tentacles and examined them under the microscope. Curiously, he evidently assumed that the shorter tentacles bear eyes, and went on to say that "though the learned *Dr Brown* [spelled with no terminal e] (my ever honoured friend) hath ranked this conceit of the eyes of a Snail (and especially their quadruplicity) amongst the Vulger errours of the multitude; yet through a good *Microscope,* he may easily see his own errour, and Nature's most admirable variety in the plurality…of the eyes". How he failed to note the lack of eyes on the short anterior tentacles is a mystery. His reference to Browne is to Sir Thomas Browne, whose *Pseudoxia Epidemica* (1646), commonly known as his *Vulgar Errors,* was a book intended to combat a wide range of commonly held erroneous beliefs.

He was also completely unaware of the presence, structure, and therefore function of a radula, saying that "They are mouthed like a Hare or Rabbit, with four or six needle-teeth like those in leeches". In making this error he was in distinguished company. Amazingly, Hooke, who described a snail in his *Micrographia*, also failed to detect the radula, a conspicuous feature in the head of slugs and snails, and unique to molluscs. He described and illustrated the jaw, a relatively small horny structure on the anterior dorsal surface of the buccal cavity near the mouth, but was clearly oblivious of the massive odontophore which carries the multi-toothed file-like radula by means of which gastropods rasp food. That two such intelligent observers (Hooke was undoubtedly a genius) could examine a gastropod without detecting its radula is a striking illustration of how what now seems obvious was by no means always necessarily so to pioneer investigators two or three centuries ago. As if to emphasise this, in his posthumously published *Biblia Naturae* (1737-1738), Jan Swammerdam (1637-1680), a superlative anatomist, illustrated the odontophore of the Roman Snail, *Helix pomatia*, but made no mention of its radula. Later in the same work, however, he did describe this structure in the aquatic snail *Paludina*. As the gastropod (and amphineuran) radula has no counterpart outside the Mollusca, its existence could not have been predicted. Conspicuous as it is, it was overlooked by several early investigators. It is also interesting that in his comments on Hooke's work, Singer (1959), in the third edition of a book first published in 1931, was also evidently unaware that Hooke had failed to notice the radula, of whose existence he himself was also perhaps oblivious. Ironically, the radula of a slug had in fact been observed under a microscope, and the pattern of its teeth reported, by Borel in 1656.

Observation 32, "Of Lampreys" is devoted mostly to his dissection to reveal the heart and its action, which, in the absence of illustrations, is not easy to visualise. Its inclusion among microscopical observations seems anomalous. One wonders where he obtained his material. Neither the Brook Lamprey nor the River Lamprey – which, like the Brown Trout and Sea Trout may be no more than 'forms' of one species – are currently known from many places in Yorkshire.

Following five non-biological observations, number 38, "The small Dust, Powder or Seeds of the lesser Moon-wort" is about the fern *Botrychium lunularia.* Power was of course unaware of the difference between the spores of ferns and the seeds of angiosperms, and the alternation of generations in the life-cycle of ferns was not to be demonstrated until almost two centuries later. It is easy to forget that what we take for granted was often

completely unknown to naturalists of the 17th century. Here he claims that these spores are the smallest of all plant seeds.

Observation 39, "The Seeds of the Wall-Rue, or white Maydenhair", is about the fern *Asplenium ruta muraria.* Power says that the leaf of this fern "hath the blackish scurff sticking to the back side of it", and that under the microscope "you shall see all the seeds look just like a sett of black Buttons upon green Taffeta; and every Button or Seed compassed with a circle or ribbe, somewhat resembling a Catterpillar: It hath been the Opinion of old Herbarists, that the Capillary plants had no seeds, which errour did rise meerly from a popular inadvertency; for though these Plants carry not their seeds in, visible Husks, Pods, Spikes, Fruits &c, yet they are constantly to be found on the back side of their leaves". In fact the "old Herbarists" were correct, but for the wrong reason, and this fern bears no seeds. Even though Power had the assistance of a new tool, a microscope, he misinterpreted what he saw and thought he had revealed the seeds unknown to earlier botanists. What he took to be seeds were sporangia, which, had he probed inside them, would have revealed that they contained spores. The "circle or ribbe", delightfully described as "somewhat resembling a Catterpillar", is the annulus which reacts to changes in humidity and plays an important part in the dehiscence of the sporangium and the dispersal of its spores.

Ironically, and of course unknown to Power, the long lost drawings produced by members of Cesi's Accademia dei Lincei that have recently come to light show that, by use of microscopes, the sori and sporangia of ferns had been identified rather more than 30 years earlier. However, it was not until 1849 that Hofmeister elucidated the life cycle of ferns, with its alternation of generations, and revealed the true nature of their spores. That this lay almost 200 years in the future gives some idea of the magnitude of the problems that Power and others faced in elucidating things which today we take for granted, and towards the understanding of which he did indeed make some progress.

The ferns on which these early observations were made could have been collected locally, but Power unfortunately says nothing about their provenance. Both were reported in the Halifax area by Bolton (1775) and both persist today (Murgatroyd 1995), the Moonwort being rare, the Wall Rue rather more common.

Two brief observations on true seeds follow – the Strawberry (40) and Corn Poppy (41). He notes how, in strawberries "Nature hath put out the seeds, as if they were sproutings from the Pulp, for these small specks or protuberances on the outside of the Strawberry are the seeds thereof". Of Corn Poppy seeds, he provides one of his rare illustrations. Webster (1967) claims that these are the first illustrations of the cells of plants, which would thus pre–date Hooke's famous illustration of cork that is usually accorded that accolade. However, what Power shows, and calls "pentagonal and hexagonal areola's", are not cells but spaces that result from the presence of ridges that impart surface patterns on the testa of the seed.

Observation 42, "The small Dust or powder on the pendents of Lillies" is again interesting because Power had no idea of the role that this 'Dust' (pollen) played in the life of flowering plants, which helps us to see just how difficult it must have been even for educated, scientifically minded individuals, to appreciate the significance of common objects and to make sense of how the natural world functions. Using an alien terminology he describes how the stamens of 'Garden Lillies' produce abundant pollen ('Dust' or 'Powder') "which will cleave to and smut your fingers", but makes no suggestion as to its function. He examined this pollen under the microscope where "you may see every Atom very distinctly to be an Oval figure exactly like some sorts of Seeds". To alter his sequence, Observation 44 is on the pollen of Pinks, which he describes as a "small Mealy Powder".

Observation 43, on "the Leaves of Several Trees and Plants" is exactly that and calls for no comment. Observation 45, "On Nettles" is brief and describes "the backside of a Nettle-Leaf" which is "full of Needles, or rather long transparent Pikes, and every Needle hath a Crystal pummel so that it looks like a Sword Cutler's Shop, full of glittering drawn Swords, Tucks, and Daggers; so that here you may see the Causes as well as you have

formerly felt the Effects of their Netling". Hooke describes the same at greater length, gives an account of how the toxin is ejected, and provides a splendid illustration. It is the latter in particular that explains why his work has always been favoured to the detriment of that of Power. That he studied several of the same plants and animals as Power perhaps indicates that his choice of subjects was influenced by those chosen by the latter whose manuscript he saw before the work was published.

In Observation 47, "A Nitt" is neatly defined as "an Egge glewed by some viscous matter to the sides of the hair it sticks to; it is Oval in shape, white in colour, and full of transparent Liquor or Gelly, and seems to be cased in a brittle shell by the cracking it makes 'twixt your nails". That his readers were obviously expected to be familiar with this object tells us something about the level of hygiene at that time. He castigates Muffet for describing it as "a quick, or rudely-shaped Animal".

Observations 48 and 49 are non-biological, and the 50th – "Of Hair" – is the last. He describes how "We slit a black Horse's Hair with a Rasor, and perceived it to be hollow, with a white streak like pith in the middle of it", and how he found that "none of them are cylindrical, but angular and corner'd". He then goes on to record that "*Borrellus* [Borel] and some of our Anatomists, as *Bartholin, Riolan* &c say the like of the Hairs of a mans head, that they also are hollow within, and angular or corner'd without, yet I could never perceive neither the one nor the other in any of the *Microscopes* I have seen though I have tried it in four excellent ones, the worst thereof I am confident was better than that of Borrels." He expected it to be hollow because bristles and quills of other mammals are hollow, yet concluded perversely – against the evidence that his examination had provided - that "I doubt not, but every one of our hairs is hollow also, which though our Glasses (by means of their transparency) cannot present". In support of this belief he refers to "an odde Experiment in Poland where there is a disease which "they call the *Plica* [Plica Polonica] which makes the very hairs of their heads drop bloud at the ends, and if they cut any where, to drop bloud there also; which infallibly proves the tubulous cavity of them". This is in fact a fungal infection, common in the past when hair went unwashed and uncombed, and has nothing to do with blood passing down a non-existent cavity in human hair.

OTHER DISCOVERIES, OPINIONS AND INTERESTS

As this is the last observation, and one of those which elicited similar observations by Hooke, it is appropriate to comment on the fact that a considerable number of matters investigated by Power were, in effect, repeated by Hooke. Power, who had completed this section of his book by 1661, presented an account of his work to the Royal Society in July 1663. Subsequently he and Hooke, as the latter put it, "interchangably viewing each others Papers, found that [Power's] were for the most part differing from mine, either in the Subject it self, or in the particulars taken notice of". His remarks notwithstanding, the similarity of the topics considered is clearly not entirely fortuitous. Certainly, when both studied the same topic, Power's observations always anticipated those of Hooke. That his efforts were overshadowed by those of Hooke is equally true. Power was an intelligent individual with an enquiring mind: Hooke was a genius. His genius included not only an ability to present his findings at a deeper intellectual level than Power, but to support them with splendid illustrations. Nevertheless, Power went further than Hooke in several respects – as in his discovery of the widespread occurrence, abundance and diversity of mites, and in his investigations of Vinegar Eels. Viewed in the context of existing knowledge, his work is in the main meritorious, and is particularly valuable in revealing the level of understanding of organisms and phenomena in the 1660s. Hooke often had Power's observations on a particular topic as a starting point for his own. Had *Experimental Philosophy* not been followed so quickly by Hooke's *Micrographia,* and had it been even modestly illustrated, it would have attracted far more attention than has been the case.

After recording his last observation Power devotes a section to discoursing on what he has reported, drawing deductions, and mentioning other observations that he has made.

While his views on such topics as what he called 'Animal spirits' are now of no more than historical interest, some of the matters raised demand attention.

Development of an embryo in the egg of a bird intrigued man from very early times, and the domestic fowl presented readily available material for study, but Power was one of the first to employ a microscope in such investigations. According to Needham (1934) he anticipated Malpighi who had been generally thought to have been the first to describe how the chick's heart begins to pulsate while the blood is still colourless. By so doing, according to Needham he confirmed microscopically the opinion of Parisanus, a Venetian physician who had suggested that this is so in 1623. Power describes how, "after the second days incubation" one can see in the centre of the cicatricula – the spot on the yolk that is the point of origin of the embryo – "a white Spot, with small white threads (which in futurity proves the Heart with its veins and arteries)", which cannot be seen by the naked eye. Moreover this rudimentary heart circulates the still colourless liquid in which it lies, "before (by a higher heat) it be turned into bloud". By what he describes as "a pretty and beneficial Observation of the Microscope", he goes on to say that, "as soon as ever you can see this red pulsating Particle appear…you shall most distinctly see it to be the whole Heart with both Auricles and both Ventricles, the one manifestly preceding the pulse of the other". This discovery contradicted the belief of the great Willliam Harvey (discoverer of the circulation of the blood) who in his *De Generatione Animalium* (1651) (English translation 1653) had expressed the belief that the heart does not begin to pulsate before the appearance of the blood. Harvey's error had unfortunate consequences for a doctrine that he proposed – "the life is in the blood" – which is discussed by Needham.

Power then goes on to identify himself as a preformationist by claiming, wrongly, that "so admirable is every Organ of this Machine of ours formed, that every part within us is entirely made, when the whole Organ seems too little to have any parts at all". While today it is difficult to see how credence could be given to the idea, this remark shows that Power subscribed to a belief in preformation, namely that, in contrast to the gradual development of organs in the embryo – epigenesis – an organ develops by the growth of already existing parts. This view attracted support for many years. Even a century later it was still held by some that every female contains the 'germs' of all her descendants, one within the other. Indeed, at that time it appeared to receive support when the parthenogenesis of aphids was investigated and it was found that in parthenogenetically produced new-born females, rudiments of the next generation can be seen. Many distinguished investigators, including Swammerdam, Malpighi, Haller and Bonnet subscribed to the belief over a long period of time. Power was at least in good company. Certainly, whatever his views on this matter, his recognition of the heart at an early stage of avian development and his demonstration that it pulsated before any red blood had formed, was a noteworthy achievement.

Much interested in eyes, he makes enlightening comparisons between those of insects and vertebrates. When he says that the "*Tunica Cornea* of most Insects is full of perforations, as if it were a *Tunica Uvea* pinked full of holes, and whereas perfect Animals have but one Aperture, these Insects have a thousand Pupils", it seems that 'aperture' and 'perforation' are used to imply 'pupil' and not actual perforations of the cornea. Particularly pertinent is his comment that the "thousand pupils" allow an insect to "see a Hemisphere at once: and indeed it is worth our consideration to think, that since their Eye is perfectly fixed, and can move no wayes; it was requisite to lattice that Window, and supply the defect of its motion, with the multiplicity of its Apertures, that so they might see at once what we can do at several times, our Eyes having the liberty and advantage to move every way (like Balls in Sockets) which theirs have not".

He also refers to "Optical Experiments" and acknowledges help from "our famous; and never to be forgotten Country-man, Master *Gascoign* of *Midleton* near *Leeds*", a Royalist who was killed in the Civil War in 1645. This was William Gascoigne, an astronomer and, more significantly, an inventor, who ground lenses, and who constructed measuring devices for telescopes that improved the accuracy of astronomical observations, of which a micrometer was particularly important. Of interest to naturalists is how he used a thread of

spider's silk inserted into the field of a telescope as a sighting device. He noticed that such a thread, which had been spun across the common focal point of the lenses, stood out sharply in the field of the telescope. When he arranged two silk threads so that they crossed at right angles in the field of view, he found that they provided an ideal measuring point. He then attached such a telescope, provided with silk threads and a micrometer, to the sighting arm of an astronomical sextant and used it to make much more accurate angular measurements than were possible when the sextant was sighted by use of a telescope lacking this device. A York firm of optical instrument makers was still collecting spider silk for such purposes until quite recently. Gascoigne survived the battle of Marston Moor in 1644, but was killed in a skirmish at Melton Mowbray in 1645, probably before he was 30 years old.

The suggestion that demands mention, however, appears to be from Power himself. He says "Take a fresh Eye, and, in a frosty Evening, place it with the Pupil upwards, where it may be frozen through, then in the Morning you may cut it as you please. If you cut it with a plain Parallel to the Optick Axis (which Section *Des-Cartes* thought impossible) then shall you see all the parts, as he has pictured them…and each part will be very different in colour, and remain in the natural Site". Although Hooke, Grew and Malpighi, who were contemporaries of Power, had cut sections of plant stems and leaves, sectioning of animal tissues had largely to await, well into the 19th century, the invention of the microtome by Jan Evangelista Purkyně (1787-1869) and Gabriel Gustav Valentin (1810-1883), and suitable means of infiltrating and embedding tissues, before much progress could be made. Power's frozen sections which, so far as I am aware, have been passed by without notice, therefore call for mention. It is worth noting that freezing is a technique that is employed in certain kinds of microtomy.

Power was particularly impressed by the mechanical complexity of small organisms which the recently invented microscope had revealed. As he made clear, even the most minute animals that he studied possessed structures and organs equivalent to those of larger animals, and could walk, swim or fly, just as could vertebrates. He regarded this as amazing and in his preface cited with approval a statement by his mentor Sir Thomas Browne from the latter's *Religio Medici*, which summarised his feelings. However, he used a slightly different form of words from that which appeared in the 'authorised' edition of that work, printed 1643. This famous book had a curious history. It was written in about 1636, and manuscript versions circulated thereafter until the work was printed without the author's knowledge in 1642. This prompted the publication by Browne of a revised, 'authorised' edition in 1643. It is not clear just which version Power cited in his preface but, as it differs slightly from that of the 'authorised' text, which is readily available, it is cited here. Although perhaps less elegant than the final version, it delightfully encapsulates the essence of his thinking. "Ruder heads stand amazed at those prodigious and Colossean pieces of Nature, as Whales, Elephants and Dromedaries; but in these narrow Engines there is more curious Mathematicks, and the Architecture of these little Fabricks more neatly set forth the wisdom of their Maker."

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ENTOMOLOGICAL REPORTS FOR 2003-2007, COLEOPTERA: STAPHYLINIDAE (ALEOCHARINAE)

M.L. DENTON

This is the first report to document the Aleocharinae of Yorkshire since those which appeared in 2003 (*Naturalist* **128**: 75-78 & 103-125). Over the years, recording the county's Aleocharinae has continued apace, albeit by a small but dedicated group of specialists, and the following report contains all species recorded new to the county or respective vice-counties. Continued interest by R.J. Marsh and E.J. Smith has added to our knowledge of distribution and W.R. Dolling, who has made available specimens for identification, has also made a valuable contribution.

A further valuable source of records has been the late E.W. Aubrook coleoptera collection. His beetle collections, when amassed, number in excess of 18,000 specimens (12,000 British and over 6,000 from New Zealand). Although most of his British material is housed at Tolson Museum, Huddersfield, the more specialised groups (Ptiliidae, Aleocharinae and *Atomaria*) are at Manchester Museum; the author having recently had the privilege of working on the Staphylinidae (including the Aleocharinae). The vast majority of the specimens, the earliest dating from 1934, are dissected, thereby making identification a somewhat easier task. After verification, each specimen was allocated a unique accession number and they have now been incorporated into the main reference collection at the Museum where they will be invaluable in allowing specialists to correctly identify their own specimens. The opportunity to extract Yorkshire data was taken and the wealth of untapped data has been incorporated into the YNU database (currently held on Recorder). Without the deposition of collections in institutions of this type, distributional information could be lost forever.

In keeping with recent Aleocharinae reports, the species' national status, as documented in the Joint Nature Conservation Committee publication *A review of the scarce and threatened Coleoptera of Great Britain, Part 2,* has been indicated. Definitions of status categories attributed to these species are as follows:

1) RED DATA BOOK CATEGORY K. RDBK – INSUFFICIENTLY KNOWN. Taxa recently discovered or recognised in Great Britain which may prove to be more widespread in the future (although some recent discoveries may be placed in other categories if the group to which they belong is thought not to be under- recorded).
2) PROVISIONAL RED DATA BOOK. pRDB. The prefix 'p' before any Red Data Book category implies that the grading is provisional.
3) NOTABLE A. Species which are thought to occur in 30 or fewer 10 km squares of the National Grid or, for less well-recorded groups, within seven or fewer vice-counties.
4) NOTABLE B. Species which are thought to occur in between 31 and 100 10 km squares of the National Grid or, for less well recorded groups between eight and twenty vice-counties.
5) NOTABLE. Species which are estimated to occur within the range of 16 to 100 km squares of the National Grid; subdivision of this category into Notable A and Notable B has not been attempted.
6) LOCAL. The term is not rigidly defined, but loosely means species confined to a particular habitat type (usually associated with better quality examples of that habitat), a particular geographic area, or species that are too widespread to warrant Nationally Scarce (Notable) status but are nevertheless infrequently encountered.

For reasons described in the first Aleocharinae report (*Naturalist* **111**: 91-96), the sex of the specimen(s) on which identification was based has been indicated; it can be assumed that all specimens were male, unless otherwise stated.

I would like to take this opportunity to thank the small number of dedicated collectors and identifiers for their continued support in documenting the Aleocharinae of Yorkshire.

The following initials appear in the list that follows: RBA = R.B. Angus; EWA = E.W. Aubrook; LA = L. Auckland; MLD = M.L. Denton; WRD = W.R. Dolling; WAE = W.A. Ely; WJF = W.J. Fordham; AG = A. Godfrey; CJ = C. Johnson; RJM = R.J. Marsh; EJS = E.J. Smith and MGT = M.G. Telfer. I would also like to thank S.A. Williams for drawing to my attention the record of *Oligota granaria.* It is also a pleasure to thank Dr Dmitri Logunov (Keeper of Zoology) and Phillip Rispin (Curatorial Assistant) of Manchester University Museum for allowing the loan of the late E.W. Aubrook collection.

The sequence and nomenclature follows Lott, D. and Duff, A. (2002) *Checklist of Beetles of the British Isles*. Staphylinidae. (Revised 28 January 2003.) www.coleopterist.org.

New county record. * New vice-county record.

Myllaena elongata (Matthews). (*61) Haverfield Quarry (TA32), female, 15/5/1999; WRD det. MLD. Patrington Haven (TA31), female, 31/3/2000, in drainage ditch; WRD (teste MLD). Found in damp places where it has been located with *Bledius* (Staphylinidae) and *Heterocerus* (Heteroceridae). The only previous records are from Scarborough (TA08) on an unrecorded date, Sandsend (NZ81) in 1935, Leven Bridge (NZ41) in 1944 and Bretton Park (SE21) in 1948. The species is afforded Notable status.
Myllaena minuta (Gravenhorst). (*62) Castle Hill Wood, Helmsley (SE58), 27/4/2007, Malaise Trap; AG det. MLD. Despite the national status of 'Common' the species has previously only been recorded from 11 widely scattered localities.
Oxypoda exoleta Erichson. (61) Brook Farm, Elstronwick (TA23), female, 5/7/2003, beaten from a *Prunus*; WRD det. MLD. (63) The record from Lockwood, Huddersfield (SE11) on 5/8/1948 was queried as past confusion with other members of the genus rendered it unreliable without a voucher specimen (*Naturalist* **128**: 105). A single male located at Manchester Museum, however, confirmed the record (teste MLD). Sprotbrough (SE50), female, 13/7/1990, reed litter in flood plain of River Don; RJM det. CJ. The only other records are from Sunk Island (TA21) in 1986, Aughton Ings (SE63) in 1988 and Rawcliffe Meadows (SE55) in 1997. The species is associated with rabbit burrows, but has been recorded from other habitats, and is afforded Notable status.
Oxypoda induta Mulsant & Rey. (61) Brook Farm, Elstronwick (TA23), female, 2/1999, in compost bin; WRD det. MLD. The only previous records are from Whitby (NZ81) in 1935, Skelder (NZ80) in 1935 and Whiteley Wood (SK38) in 1998.
Amarochara umbrosa (Erichson). (*63) Sheffield (EJS's garden) (SK38), 27/7/2001; EJS det. MLD. The only previous records are from Saltburn (NZ62) in 1896 and Netherby Dale (SE98) in 1988. This nationally Notable species is associated with the subterranean runs of small mammals.
Phloeopora corticalis (Gravenhorst). (*65) High Spring Wood (SE19), 27/4/2006, under *Fraxinus excelsior* bark; MLD. This nationally Notable species is restricted to England where it is associated with woodland, wood-edge and scrub.
Meotica exillima Sharp. (*61) Allerthorpe Common (YWT reserve) (SE74), female, 24/4/2004, in logs; RJM det. MLD. (*62) Strensall Common (SE66), female, 31/5/2006, in damp ground litter; RJM. (*64) Askham Bog (SE54), 29/6/1966; EWA det. MLD. The only previous records are from Agden (not the YWT reserve) (SK29) in 1987 and Rushy Moor (SE51) in 1987.
Ischnopoda coarctata Erichson. (*62) Cayton Bay (TA08), 13/7/2006, cliff top vegetation; MGT det. RJM (teste MLD). This nationally Notable species is generally found in reed beds and in river and lake margins in southern Britain (north to Yorkshire). The only previous record was from Green Wood (formerly Kaye Wood) (VC63) in 1948.
Ischnopoda constricta (Erichson). (*63) Sprotbrough Flash (SE50), not sexed, 29/6/1972; EWA det. MLD. Despite being widely distributed in the British Isles, the other 14 Yorkshire records are all from the northern half of the county.
Dacrila fallax (Kraatz). (*63) Sprotbrough Flash (SE50), female, 29/6/1972; EWA det.

MLD. Sykehouse (SE61), female, 16/6/2005, sweep netting around a pond; RJM. Elland Gravel Pit (SE12), both sexes, 28/4/2007, pond side debris; MLD. The only other records are from Spurn (TA41) in 1948, Haverfield Quarry (TA32) in 1991, Fisherman's Channel (TA21) in 1991 and Broomfleet (SE92) in 1993. This nationally Notable wetland species is confined mainly to southern Britain, Yorkshire being at the species' northern limit.

Callicerus rigidicornis (Erichson). (*62) Castle Hill Wood, Helmsley (SE58), 25/5/2007, Malaise Trap: AG det. MLD.

#Aloconota languida (Erichson). (61) The records from Bubwith (SE73) in 1915, 1918 and 1919 were queried since past confusion with other members of the genus rendered them unreliable without voucher specimens (*Naturalist* **128**: 110). The presence of a single male in the Manchester Museum Collection, collected from flood refuse in 11/1919, however, confirmed the 1919 record; WJF (teste CJ). (65) Sharow Mires (SE37), 27/6/2002; RJM (teste MLD). The species is afforded Notable status.

#Neohilara subterranea (Mulsant & Rey). (63) Blaxton Common (SE60), 8/7/1972; EWA det. MLD. Hatfield Moor (SE60), 25/7/2006, water trap; AG det. MLD. Records show that this pRDBK species is confined mainly to Scotland, although there are extralimital records from Northumberland and Herefordshire.

Alaobia pallidicornis (Thomson). (*65) Sharow Mires (SE37), 6/8/2002; RJM det. MLD.

Alaobia taxiceroides Munster. (63) Beaumont Park, Huddersfield (SE11), female, 13/6/2004, in decaying fungi; MLD. The only previous records are from Woodhouse Plantation (SE98) in 1995, New House Wood (SE10) in 1998, Toftwood (SK38) in 1998, Molly Carr Wood (SE11) in 1999 and T.P. Wood, Marsh (SE11) in 2001.

Brundinia meridionalis (Mulsant & Rey). (61) Reighton Gap (TA17), both sexes, 12/7/2006, cliff top vegetation; MGT det. RJM. The previous Yorkshire records are all from the lower reaches of the Humber Estuary (VC61): Spurn (TA41) in 1952, Sunk Island (TA21) in 1986, Beacon Ponds (TA41) in 1990 and Fisherman's Channel (TA21) in 1991.

Liogluta longiuscula (Gravenhorst). (*65) Richmond (NZ10), female, 29/7/2005, pitfall trap in river shingle; AG det. MLD.

Dilacra vilis (Erichson). (63) Potteric Carr YWT (Loversall Delph) (SE50), female, 28/5/2002, in bracket fungus on *Salix* in wet carr; EJS (teste MLD). Sykehouse (SE61), 12/7/2005, debris around edge of a dried up pond; RJM. The only previous records of this nationally 'Local' species are from Sprotbrough (SE50) in 1987, Askham Bog (SE54) in 1994 and 1996, and Staveley Lagoon (SE36) in 1995.

Microdota benickiella Brundin. (63) Rivelin (SK28), female, 5/1/1993; EJS det. MLD. The only previous records are from Studley (SE27) on an unrecorded date and Askham Bog (SE54) in 1997. This nationally Notable species is generally associated with woodland.

Microdota boreella (Brundin). (63) Pighill Wood (SE01), female, 8/6/2006, in a long dead Carrion Crow; MLD. (*64) Church Wood, Leeds (SE23), female, 27/4/2007, compost heap; MLD. The only previous record of this nationally Local species is from Blackmoorfoot Reservoir (SE01) in 1990.

#Microdota excelsa Bernhauer. (63) Dyson Wood (SE11), 11/5/2006, in grass cuttings; MLD. Widely distributed in the British Isles where it is found in broad-leaved woodland, pasture and sallow carr. The species is afforded Notable status.

Microdota subtilis (Scriba). (63) Ecclesall Wood (SK38), female, 28/7/2001, in gill fungus on logs in deciduous woodland; EJS (teste MLD). The only previous records are from Bishop Wood (SE53) in 1984, Askham Bog (SE54) in 1969 and Wharncliffe Wood (SK39) in 1988.

Mocyta orbata (Erichson). (*62) Old Quarry Rocks, Filey (TA18), female, 21/5/2005, strand line debris; RJM. (*64) Upper Dunsforth Carrs (SE46), female, 7/6/2005, sweeping vegetation; RJM. (*65) Felham Ranges (NZ00), 18/8/1990, in mature woodland; WAE.

Datomicra canescens (Sharp). (63) Wickersley Wood (SK49), female, 27/5/2005; WAE (teste MLD). Blackmoorfoot Reservoir (SE01), female, 9/6/2007, stable refuse; MLD. The only previous record of this nationally Common species, which is associated with dung, is from Eggborough (SE52) in 1985.

Atheta basicornis (Mulsant & Rey). (64) Askham Bog (Middle Wood) (SE54), both sexes, 12/4/2003; WRD (teste MLD). The only previous records are from Thorne Moor (SE71) in 1985, Askham Bog (SE54) in 1996 and Sharow Mires, Ripon (SE37) in 2002. The species is restricted to England where it is associated with wet habitats and is afforded Notable status.

Atheta intermedia (Thomson). (63) Blackmoorfoot Reservoir (SE01), female, 7/6/2005, decaying grass heap; MLD. The only previous records are from Malham Tarn (SD86) in 1954, Elland Park Wood (SE12) in 1985, Swinden Plantation (SE10) in 1988 and Spurn (TA41) in 2001.

Atheta nidicola (Johansen). (64) Askham Bog (Middle Wood) (SE54), female, 16/4/2005, pile of cut vegetation; MLD. The only previous records are from Dalby Forest (SE88) in 1966, Askham Bog (SE54) in 1967, Blackbrook Wood (SK28) in 1992 and Ewden Pond (SK29) in 1997.

Atheta nigricornis (Thomson). (*65) Orgate Farm, Marske (NZ10), female, 6/8/2005, in dry fungi; MLD.

Atheta nigritula (Gravenhorst). (63) Coppice Wood, Rivelin (SK28), 10/8/1998; EJS. Rivelin Nature Trail (SK28), both sexes, 16/8/1998, in gill fungus on logs in deciduous woodland; EJS (teste MLD). The only previous records are from Wharncliffe Wood (SK39) in 1992, Skipwith Common (SE67) in 1993 and Rivelin (SK28) in 1998. This nationally Notable species is mainly restricted to southern England, but with scattered records north as far as south-east Scotland.

Atheta oblita (Erichson). (63) New Park Spring (SE40), 12/9/2003, in fungi; MLD. The only previous records are from Saltburn (NZ62) in 1897, Potter Brompton (SE97) in 1986, May Moss (SE89) in 1996 and Toftwood, Rivelin (SK38) in 2000.

Atheta pilicornis (Thomson). (64) Cayton Gill (SE26), 5/5/2005, under *Betula pendula* bark; MLD. The only previous record is from Saltburn (NZ62) in 1893. This nationally Notable species is associated with woodland and is found in England and southern Scotland.

Dimetrota cauta (Erichson). (61) Hornsea Mere (TA14), female, 22/5/2003, sweeping in a *Phragmites* bed; RJM (teste MLD). Sunk Island (Hawkin's Point) (TA21), female, 18/8/2004, in tide-line refuse; RJM (teste MLD). (*63) Potteric Carr (Loversall Delph) (SE50), female, 10/5/2002; RJM (teste MLD). Despite the national status of 'Common', there are only two previous records: Spurn (TA41) in the mid-20th century and Ringhay Wood (SE43) in 1989.

Dimetrota ischnocera Thomson. (*65) Orgate Farm, Marske (NZ10), female, 6/8/2005, in dry fungi; MLD.

#Acrotona benicki (Allen). (62) Wykeham Forest (SE98), 5/8/2001; LA det. MLD. The species has a national status of pRDBK.

Aleochara cuniculorum Kraatz. (*65) Nosterfield N.R. (SE27), female, 20/8/2002, in a dead bird; RJM (teste MLD). The only previous records are from Skipwith Common (SE63) in 1919, Kearby (SE34) in 1937, Askwith (SE14) in 1937, Spurn (TA41) in the mid-20th century and Blackmoorfoot Reservoir (SE01) in 1987.

Aleochara discipennis Mulsant & Rey. (63) Wharncliffe Crags (SK29), 2/5/2000; EJS (teste MLD). The only previous record is from Roche Abbey (SK58) in 1986. This nationally Notable species is predominantly southern in distribution, but there are occasional records from northern Britain.

Aleochara kamila Likovsky. (*64) Knaresborough Ringing Station (SE35), emerged 3/1971, from an old Starling nest; EWA det. MLD. Little is known about the British distribution of this Notable species as problems with nomenclature have clouded the picture. It is possible that it is a southern species which is found north to Yorkshire. The only other authentic records are from Drop Clough (SE01) in 1987, May Moss (SE89) in 1996 and Willowgarth, Knottingley (YWT reserve) (SE52) in 1992 and 1993.

Aleochara moerens Gyllenhal. (63) Langsett (SK19), female, 7/12/2007, from gill fungus on *Acer pseudoplatanus*; EJS. The only previous record of this nationally Notable species was from the same locality (probably the same tree) in 1985.

Aleochara moesta Gravenhorst. This species was not included in the Yorkshire List as the five records require confirmation due to past confusion with nomenclature (*Naturalist* **128**: 124-125). The specimens from Adel Dam (VC64) dated 17/11/1963 have been located in the Leeds Museum Resource Centre and re-identified as *A. lanuginosa* Gravenhorst (det. MLD). This species is almost ubiquitous in cow dung (and other habitats) throughout the British Isles and is widely distributed in Yorkshire.

Falagrioma thoracica Stephens. (63) Bradley Gate Wood (SE11), female, 6/6/2006; MLD. Despite the national status of 'Local' the only previous records are from Wentbridge (SE41) in 1879 and Saltburn (NZ62) in the early 20th century.

Myrmecopora sulcata (Kiesenwetter). (61) Old Quarry Rocks, Filey (TA18), female, 21/5/2005, strand-line debris; RJM det. MLD. The only previous records are from Scarborough (TA08) on an unrecorded date, Saltburn (NZ62) in 1896 and Spurn (TA41) in 1919 and during the mid-20th century. The species is associated with sandy shores, often below the high water line.

Encephalus complicans Stephens. (*65) Foxglove N.R., Waithwith (SE19), not sexed, 19/5/2001, swept from marsh vegetation; WRD.

Gyrophaena joyioides Wuesthoff. (63) Anston Stones Wood (SK58), 5/9/2004, in fungi; WAE det. MLD. (64) Harlow Carr Gardens (SE25), 18/9/2004, in fungi in woodland; MLD. The only previous records are from Hetchell Wood (SE34) in 1989, Rivelin (SK43) in 1993, Ringhay Wood (SE43) in 1993, Upper Dunsforth Carrs (SE46) in 1999 and Breary Marsh (SE24) in 1999. The species is mainly restricted to southern England and is afforded Notable status.

#Gyrophaena munsteri Strand. (62) Cayton Bay (TA08), 18/6/1995, in *Polyporus squamosus*; RBA (teste MLD). (64) Hack Fall Wood (SE27), 16/6/1996, in vegetable refuse by the River Ure; RJM det. MLD. Generally found in fungi on trees the species has a national status of pRDBK.

Cypha pulicarius (Erichson). (61) Haverfield Quarry (TA32), 15/6/1996, grass pile in meadow; WRD det. MLD. (63) Coppers Lake, Crofton (SE31), 7/4/2005, old grass pile; MLD. Screamer Wood (SE12), 23/5/2006, grass pile; MLD. The only previous records are from Mulgrave Wood (NZ81) in 1934, Dunnington Common (SE65) in 1971, Morton Wood (SE10) in 1985, Aughton Ings (SE63) in 1988 and Fountains Abbey (SE26) in 1995. The species is associated with bogs and marshes and is afforded Notable status.

#Holobus flavicornis (Boisduval & Lacordaire). (63) Sheffield (EJS's garden) (SK38), female, 26/7/2001; EJS (teste MLD). Generally found amongst dead leaves, although it is possible that the species is an arboreal predator of mites and aphids. The species is widely distributed in England and is afforded Notable status.

Oligota granaria Erichson. This species was omitted from The Aleocharinae (Coleoptera: Staphylinidae) of Yorkshire (*Naturalist* **128**: 103-125), but an undated record from Scarborough which appears in Fowler's monumental work *The Coleoptera of the British Isles* Vol. II (1888) has been brought to the author's attention. Interestingly, this record does not feature on the original YNU record cards, nor is it documented in *The Natural History of the Scarborough District* published by the Scarborough Field Naturalists Society in 1956.

Oligota picipes (Stephens). (*61) Blenkins Farm, Owstwick (TA23), 15/11/2002, hay under shelter; WRD det. MLD. (63) Blackmoorfoot Reservoir (SE01), 26/5/2005, decaying grass heap; MLD. The only previous records are from Stoney Royd (SE30) in 1987, Staxton (TA07) in 1996 and Rawcliffe Meadow (SE55) in 1997.

Oligota pusillima (Gravenhorst). (63) The record from Dalton, Huddersfield (SE11) on 31/10/1948 was queried, as past confusion with *O. pumilio* Kiesenwetter rendered it unreliable without a voucher specimen (*Naturalist* **128**: 124). A single male located in the EWA Collection at Manchester Museum, however, confirmed the record (teste MLD). (*64) Harewood Park (Walled Garden) (SE43), 25/6/2005, old straw; MLD. There are now 17 Yorkshire records from 15 localities: VC61 (4), VC62 (2), VC63 (8) and VC64 (1).

DISTRIBUTION OF *NARYCIA DUPLICELLA* (GOEZE 1783) (LEPIDOPTERA: PSYCHIDAE) IN YORKSHIRE

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39 Hawthorn Drive, Holme on Spalding Moor, York YO43 4HX

Introduction

The moths in the family Psychidae are an under-recorded group primarily due to their small size and high degree of crypsis exhibited by the larvae which make cases out of lichens and dead leaves. Nine species have been found in Yorkshire, the majority of which until recently have been rarely recorded. This paper describes the distribution of one species *Narycia duplicella* (formerly *N. monilifera* Geoffroy 1785). Until recently, the moth was considered to be rare in Yorkshire with only three known records prior to 2004.

Description of larval case

The following description of the larval case is adapted from Heath and Emmet (1985). The larva constructs a case from lichens and other plant material and tends to be solitary although several can usually be found on the same tree. The case is triangular in cross-section, 5 - 6 mm long x 1.5 - 2 mm wide when full grown and has characteristic "keels" at the distal end. Figure 1 shows a typical full grown larva found at Skipwith Common in Yorkshire in 2006. The colour of the case is dependent on the algae or lichens on the substrate (as clearly illustrated in Figure 1) and is highly cryptic, often resting in crevices in the bark. Heath and Emmet (1985) state that the larva feeds on algae growing on a variety of surfaces, such as trees, rocks and fences. The author has noted that virtually all larvae in Yorkshire have been found on trees rather than other surfaces and is especially associated with the lichen *Lecanora conizaeoides*. The author has also noted that the majority of cases are typically found on the northern side of a tree and up to 2 m above ground although the majority occur below 1 m. Figure 2 shows the adult moth which has a typical wingspan of 9-12 mm (male) and 7-10 mm (female). The adult is on the wing in June and July.

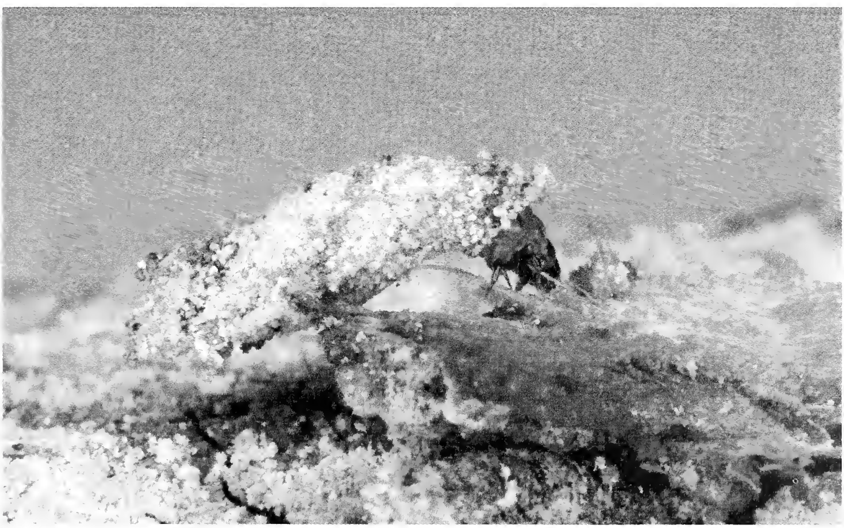

FIGURE 1. *N. duplicella* larva from Skipwith Common near York, 9/2/2006.

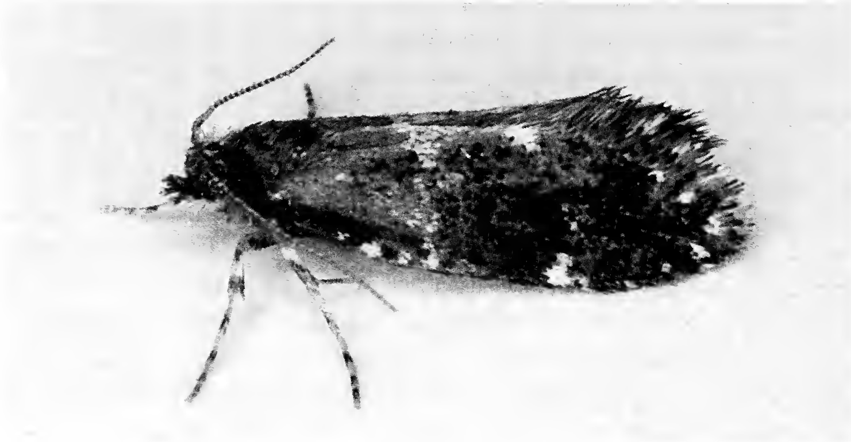

FIGURE 2. Adult *N. duplicella* hatched June 2005 from case found at Skipwith Common in April 2005.

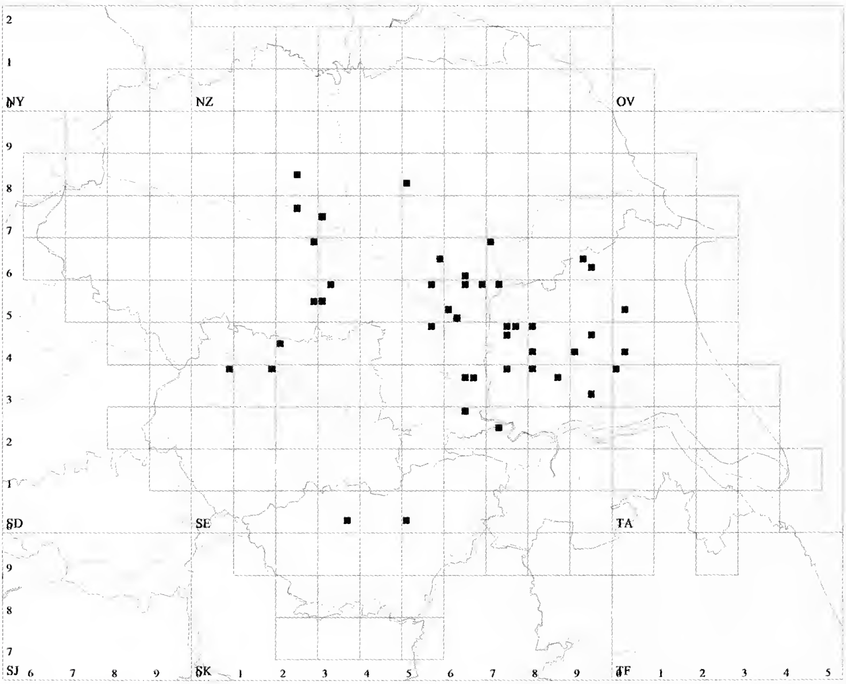

FIGURE 3. 2 km distribution map of *N. duplicella*. All records 2004-2007.

DISTRIBUTION IN THE UK

Pre-1900 references to this species include Morris (1871) which gives localities of York, Birkenhead, Manchester and Bristol under the name *Xysmatodoma melanella*, and Meyrick (1895), under the name *Narycia melanella*, states that it is "Common to York", which is interpreted as being common throughout Britain to York at its northern boundary. A record listed in Sutton and Beaumont (1985) states that it was mentioned in Stainton (1859) as occurring in York. More recently, the moth has been described as "Common in southern England and Wales, becoming more local northwards to southern Scotland" (Heath & Emmet 1985).

DISTRIBUTION IN YORKSHIRE

The map in Heath and Emmet (1985, p. 133) shows the moth as being present in Cumbria, Lancashire and Yorkshire (VC 62 North-east Yorkshire), the latter probably referring to the record in Stainton (1859) since no other records can be found. Only two records are listed in Sutton and Beaumont (1987), namely York (as above) and Lindrick Common (SK5582) in VC 63. A further record from Strensall Common near York in 1992 (recorded by M.R. Brittain) is listed in Beaumont (2002).

A search for larval cases began in 2004 and it soon became apparent that the species is actually widespread in the southern half of the county and appears to have been simply under-recorded. A total of 43 sites have been recorded between 2004 and 2007 (Figure 3) in 32 10 km squares (Figure 4). A complete list of first records including grid references is given in Table 1. The following summarises notable sites by vice county.

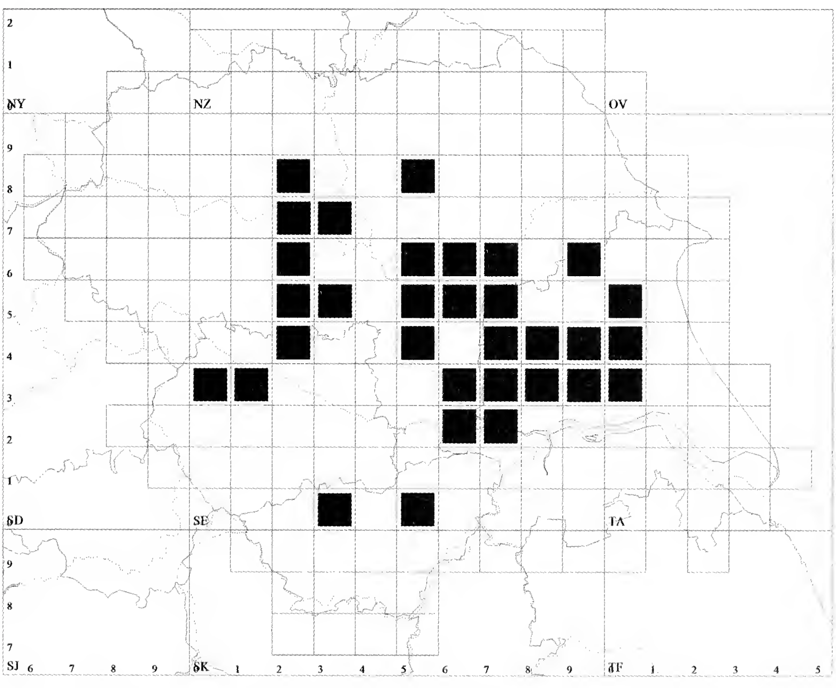

FIGURE 4. 10 km distribution map of *N. duplicella*. All records 2004-2007.

TABLE 1.
N. duplicella records in Yorkshire since 2004.

Site	**VC**	**Grid Reference**	**Recorder**	**Date of First Record**
Allerthorpe Wood, car park area	61	SE751473	D. Chesmore	27/04/2005
Allerthorpe Wood, Grey's Plantation	61	SE7648	Chesmore, S. & D. P. Bone	20/09/2006
Barnby Moor, Cali Heath	61	SE7549	H.E.Beaumont	22/04/2006
Beverley, Burton Bushes	61	TA011393	D. Chesmore	18/02/2007
Buttercrambe Village	61	SE739582	D. Chesmore	3/05/2005
Cranswick, Village Green	61	TA025522	D. Chesmore	25/04/2006
Everingham, Woodlands Nursery	61	SE812438	D. Chesmore	16/04/2006
Holme on Spalding Moor	61	SE813387	D. Chesmore	3/01/2005
Holme on the Wolds, Little West Field	61	SE943467	D. Chesmore	25/04/2006
Kiplingcotes near Market Weighton, Chalk Pit	61	SE916435	D. Chesmore	17/04/2004
Laytham near Bubwith	61	SE754388	D. Chesmore	12/04/2005
Leconfield Carrs	61	TA030435	D. Chesmore	1/05/2004
North Cliffe, North Cliffe Wood	61	SE865375	D. Chesmore	2/05/2004
Pocklington, Burnby Hall Gardens	61	SE804486	D. Chesmore	23/08/2005
Skipwith, Skipwith Common	61	SE660375	D. Chesmore	27/03/2004
Sledmere Estate B1252	61	SE951630	D. Chesmore & A.S.Ezard	27/04/2006
Sledmere Village Centre	61	SE928646	D. Chesmore	27/04/2006
South Cave, Cave Wold	61	SE947325	D. Chesmore	25/02/2007
York, York University*	61	SE622505	D. Chesmore	23/04/2004
Castle Howard Estate, Bracken Hill	62	SE705695	D. Chesmore	9/10/2005
Gormire Lake and Garbutt Wood	62	SE5083	C. Fletcher	15/03/2007
Sand Hutton, Sand Hutton Common	62	SE680580	D. Chesmore	22/03/2007
Strensall, Strensall Common	62	SE647615	D. Chesmore	13/05/2004
Sutton on the Forest, Sutton Park	62	SE585645	D. Chesmore	23/04/2005
Wigginton, Moorlands Nature Reserve	62	SE576590	D. Chesmore	15/04/2007
York, City Centre	62	SE603522	D. Chesmore	4/04/2006
Airmyn Village	63	SE725253	D. Chesmore	23/03/2005
Bingley, St Ives Estate	63	SE099393	Derek Parkinson	26/04/2006
Bingley, St. Ives Country Park	63	SE0938	D. Parkinson	26/04/2006
Melton Wood	63	SE5103	H.E.Beaumont	10/03/2005
Wombwell, Wombwell Wood	63	SE3702	H.E.Beaumont	29/03/2005
Drax Power Station nr Selby	64	SE653282	D. Chesmore	25/04/2004
Esholt, Gill Wood	64	SE191397	D. Parkinson	3/04/2006
Grewelthorpe, Hackfall Woods	64	SE2477	C. Fletcher	11/03/2006
Harrogate, RHS Harlow Carr Gardens*	64	SE280540	D. Chesmore	15/05/2004
Knaresborough, Nidd Gorge	64	SE3258	C. Fletcher	2/03/2006
Mackershaw Wood near Ripon	64	SE2968	C. Fletcher	16/03/2006
Mickley, Mickley Barras	64	SE2476	C. Fletcher	20/04/2006
Otley, Otley Chevin	64	SE2044	Derek Parkinson	25/04/2006
Ripon, Ripon Parks	64	SE3075	C. Fletcher	4/03/2006
York, Askham Bog	64	SE570480	D. Chesmore	23/06/2004
Bedale, Thorp Perrow Arboretum*	65	SE2585	Charles Fletcher	9/03/2006

* New Vice County Record

VC 61 (South-east Yorkshire). The majority of records are from this VC, the furthest east being Leconfield north of Beverley. Most larvae recorded by the author have been found on Oak with relatively few on Hawthorn, but in the Yorkshire Wolds (Holme on the Wolds and Kiplingcotes), the larvae have been found only on Hawthorn. In one case, near Holme on the Wolds, more than 10 larvae were found on a single Hawthorn bush in a very isolated location. Two observations can be drawn from his particular location (Figure 5). Firstly, the relative isolation of the copse means that the adults must be able to fly distances exceeding several 100 m, and secondly, the average height of the trees is very small, less than 3 m. Indeed, all Hawthorns on which larvae have been found are less than 3 m in height. It is therefore important to investigate any trees with the correct lichen flora no matter how small or isolated they may be. The larval case is also much paler than those found on Oak due to the presence of other lichens.

FIGURE 5. Small copse near Holme on the Wolds in VC61 illustrating the relative isolation of the site and the small size of the trees on which *N. duplicella* has been found.

VC 62 (North-east Yorkshire). Most of the records are confined to the southern part of the VC, occurring in the Vale of York, York city centre and at Strensall Common. The records from York city centre are from trees in urban settings. There is only one record to date in the North York Moors, at the extreme western end (Garbutt Wood near Thirlby), but it is expected that it is widespread on the Moors.

VC 63 (South-west Yorkshire). There are only five known recent localities: Wombwell Wood, Melton Wood, Airmyn near Goole and Bingley (two localities close together). It is expected that the moth should be more widespread, but VC 63 is considerably more urban than other VCs. Urban areas have higher levels of air pollution which restrict the number and quantity of lichens and therefore may not provide a suitable habitat.

VC 64 (Mid-west Yorkshire). The majority of records are from the Harrogate and Knaresborough areas, including cases on Oak at Harlow Carr near Harrogate. Other sites of

interest include Drax Power Station (Barlow Ash Mound Nature Reserve) and Askham Bog near York.

VC 65 (North-west Yorkshire). To date, there have been only two records, both from the same site at Thorp Perrow Arboretum near Bedale; this is the most northerly site in Yorkshire. Searches should be made further north and west.

Conclusions

The highly cryptic nature of this species suggests that it has simply been overlooked in Yorkshire. Intensive searches since 2004 have revealed that it is widespread and any tree with lichens should be investigated. One possible exception to this is the Beech; the author has not yet found any larvae on this species. The northern limit in Yorkshire at present is Bedale and the western edge of the North Yorkshire Moors. However, since there are records from Scotland (Heath & Emmet 1985), its distribution is probably continuous throughout Yorkshire and Northumbria, and into Scotland.

Acknowledgements

The author would like to thank the various people in Table 1 for granting permission to use their records.

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BOOK REVIEW

Philip's Guide to Wild Flowers of Britain and Northern Europe by **Bob Gibbons** and **Peter Brough.** Pp. 376. Octopus Publishing Group, London. 2008. £9.99 paperback.

This pocket-sized guide to plants of the northern half of Europe features the 1000 species which the authors believe are those most likely to be noticed because of their abundance or their distinctive appearance. The families and species are given in the same order in which they appear in *Flora Europaea* but the names have been updated. The introductory section has a glossary and deals with the parts and structure of flowers and the shape and arrangement of leaves, followed by an illustrated key to families. One can then turn to the relevant page and identify a plant using the text and illustrations. Coloured drawings with helpful annotations point out a species' distinguishing features. Small maps alongside the text show a plant's distribution across northern Europe and the British distribution is mentioned within the text. This is a useful aid to plant identification which can be helpful both at home and elsewhere in northern Europe.

PPA

THE ROLE OF BEACON LAGOONS NATURE RESERVE IN MACROPHYTE CONSERVATION

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The South Holderness Countryside Society celebrates its 25th Anniversary this year. It is proud to possess a significant nature reserve, The Beacon Lagoons Nature Reserve (BLNR), within a region that is a candidate for designation as a Special Protection Area under European criteria for classification. This Reserve has been assembled over time from several packets of land situated on the coast between Easington and Kilnsea and includes Easington Lagoon, leased from the Environment Agency.

On 31 August 2007, Natural England submitted the Humber estuary, including BLNR, as being worthy of designation as a Special Area of Conservation (Register entry UK0030170) under the Conservation (Natural habitats etc.) Regulations 1994. The estuary has been identified as having priority status under Article 4.2 of the Habitats Directive (Council directive 92/43/EEC) because it hosts one or more priority natural habitat types or priority species. If accepted, the estuary, including BLNR, will be part of the European Union-wide Network of protected areas known as Natura 2000.

The reserve has already been classified as a Special Protection Area under the EC Birds Directive (79/409/EEC) and is listed as a Wetland of International Importance, especially as Waterfowl Habitat (i.e the "Ramsar Convention").

Habitats

Thirteen priority natural habitat types or priority species have been identified, of which the following eight habitat types occur within BLNR:

- Coastal lagoons
- Fixed dunes with herbaceous vegetation ("grey dunes")
- Dunes with *Hippophae rhamnoides*
- Embryonic shifting dunes
- Shifting dunes along the shoreline with *Ammophila arenaria* ("white dunes")
- Mudflats and sandflats not covered by seawater at low tide
- *Salicornia* and other annuals colonising mud and sand
- Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)

Although every one of these eight priority natural habitat types can be found elsewhere around the Humber estuary, all eight occur, interlinked, within BLNR. This account illustrates each habitat type with its association of notable plant species.

Coastal lagoons

There is a complex of saline lagoons that were generated either as borrow pits for flood defence barrier construction or for habitat creation. With the exception of the northernmost (Easington) lagoon, these overlie boulder clay and have a deep, dynamic water column that sustains a heavy suspension of particles with poor light transmittance properties. This is totally unsuitable for macrophyte growth. However, the Easington lagoon and other smaller water bodies on the reserve overlie sand and shingle and *Ruppia cirrhosa* and *R. maritima* occur in these (Crackles, 1983; Cook, 2003). The filamentous alga *Chaetomorpha linum* is abundant in parts of the more recently excavated lagoons. A linear lagoon created by the excavation of a ditch has become populated with a variety of stoneworts, including the regionally uncommon *Tolypella glomerata*, as well as *Ranunculus baudotii* and *Ruppia cirrhosa*.

Dunes with Hippophae rhamnoides *and fixed dunes with herbaceous vegetation ("grey dunes")*

Immediately to the south of Easington lagoon there is an area of fixed dune populated with *Hippophae rhamnoides* at its northern tip. This is associated with established *Elytrigia atherica* and scattered *Senecio erucifolius*, *S. sylvaticus* and *Sonchus arvensis*. This fixed dune extends southwards, with areas dominated by *Carex arenaria*, *Potentilla anserina*, *Cerastium diffusum*, *Galium verum* and *Honckenya peploides*. Scattered within this ground cover are occasional occurrences of *Blackstonia perfoliata*, *Centaurium erythraea* and *Trifolium fragiferum*. It is envisaged that there will be management conflicts here should the Sea Buckthorn spread southwards.

Embryonic shifting dunes and shifting dunes along the shoreline with Ammophila arenaria *("white dunes")*

These are well represented along the east side of the reserve, being fragmentary at the northern end bordering the Easington Lagoon and becoming intermittently 'fixed' or 'shifting' in segments southwards. Typically, the flora of embryonic shifting dunes here is *Ammophila arenaria*, creating a nucleus for new dune formation following blow-out of stable *A. arenaria*, *Leymus arenarius* and *Elytrigia juncea*. *Cakile maritima* and *Atriplex prostrata* with occasional *Eryngium maritimum*, *Atriplex laciniata* and *Salsola kali* subsp. *kali* are found among these systems.

Mudflats and sandflats not covered by seawater at low tide

The physical structure of intertidal flats ranges from mobile, coarse-sand beaches on wave-

FIGURE 1: Coastal lagoon; grey and white dunes; dunes with *Hippophae rhamnoides* and mud/sand flats. Photo P. J. Cook© 2006

exposed coasts to stable, fine-sediment mudflats in estuaries and other marine inlets. This habitat type can be divided into clean sands, muddy sands and muds, although in practice there is a continuous gradation between them. Within this range the plant and animal communities vary according to the type of sediment, its stability and the salinity of the water. These are very well represented in the Humber estuary but on BLNR occur only along the shore of the lagoons and in a scraped area to the south of the lagoons. These areas tend to be inundated by annual high tides and become exposed as the water column in the lagoons falls through drainage and evaporation. Typical flora includes *Juncus gerardii*, *Honckenya peploides, Atriplex prostrata, Aster tripolium* and occasional *Seriphidium maritimum*, *Apium graveolens* and *Suaeda maritima*. At one location, *Carex distans* occurs at one of only a few known S. E. Yorkshire sites.

Salicornia *and other annuals colonising mud and sand*

An area to the south of the bird observation hide has developed a mosaic of well-characterized salt marsh communities dominated by *Salicornia europaea*, *S. maritima*, with occasional *Aster tripolium*, *Limonium vulgare*, *Spergularia marina* and *Atriplex portulacoides*. On drier marginal areas with in-blown sand, *Juncus ambiguus* occurs, still in the general locality of it's first finding (Crackles, 1986), together with *Puccinellia distans*.

Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)

At the extreme northern (Easington) end of BLNR is an area of rough grassland showing some features of salt meadow that includes *Carex divisa*, first recorded by A. T. Dobson in

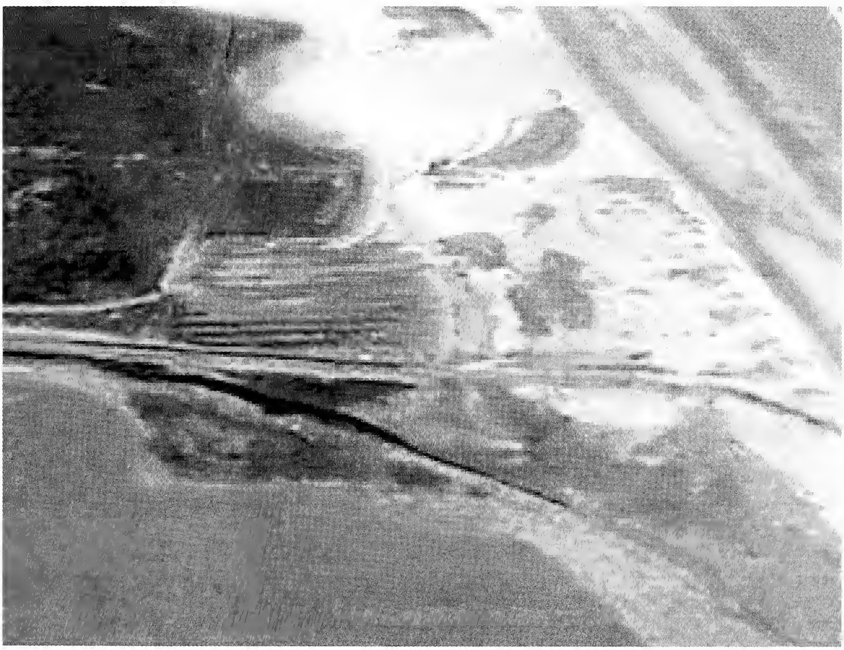

FIGURE 2: Coastal lagoon; embryonic, fixed and shifting dunes; *Salicornia* and other annuals colonising mud and sand, and Atlantic salt meadow in old 'ridge and furrow'. Photo P. J. Cook© 2005

1970 (Crackles, 1990), and subsequently refound by the author in 1996. The location also includes an area of old 'landed' meadow. This is not medieval ridge and furrow but a more recent plough-thrown furrowing to effect land drainage. The shallow furrows have a flora consisting predominantly of *Glaux maritima*, *Puccinellia maritima*, *P. distans*, *Triglochin maritimum* and *Plantago maritimum.* An area of land recently acquired by the South Holderness Countryside Society and appended to BLNR in 2000 is expected to experience tidal inundation once dunes on its eastern margin erode away. Low-lying areas of this land are already developing aspects of Atlantic salt meadow and there is considerable future promise of the natural development of this scarce habitat type on this highly diverse and dynamic reserve.

CONSERVATION OF SCARE AND RARE MACROPHYTES

Most of the plants mentioned above are locally and regionally scarce or rare by virtue of the highly limited availability of suitable habitats in the region. Habitat conservation is therefore critical if the region is to keep these species and their attendant fauna. For the conservation status of the plant species at a National (and European) level it is necessary to consult Dines, *et al.* (2005), where six species occurring on BLNR are listed.

Species listed as Vulnerable (i.e. species considered to be facing a high risk of extinction in the wild) are *Carex divisa* and *Salsola kali* subsp. *kali.* Although *Ruppia cirrhosa* does not qualify as "Critically Endangered", "Endangered" or "Vulnerable", it is nevertheless close or likely to qualify for a threatened category in the near future, and is therefore listed as 'Near Threatened'. Species listed as being of International importance because the UK definitely holds more than 25% of the European population are *Atriplex laciniata* and *Cerastium diffusum. Seriphidium maritimum* is also possibly in this category.

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THE ROLE OF BEACON LAGOONS NATURE RESERVE IN INVERTEBRATE CONSERVATION

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The South Holderness Countryside Society (SHCS) was founded in 1983 in order, among other objectives, to engage in the conservation of wildlife within its geographical area. Interest in the Little Tern colony at Kilnsea led to the Society's acquisition of 37 acres of littoral land and saline lagoon between the sea defences and the North Sea, immediately south of the 33-acre holding owned by the NRA (now the Environment Agency) and leased to the SHCS. A further 22 acres of agricultural land subject to saline encroachment and

windborne sand were later acquired to extend the site further south. Management of the site is in the hands of the SHCS, with involvement of the Spurn Bird Observatory in organising the Little Tern Protection Scheme.

The whole Beacon Lagoons site, variously known as Beacon Ponds, Kilnsea Lagoons and Easington Lagoons, lies to the seaward side of the artificial embankments called the Long Bank and, in the northern half, where the Long Bank was breached by the floods in 1953, the New Bank. North Lagoon was formed by the 1953 flooding. South Lagoon is, in part, a borrow pit. The water in the lagoons is strongly saline but not tidal, though some storm surges often temporarily connect them with the sea, introducing marine organisms that may persist for some years. There is an area of non-tidal saltmarsh and some low dunes that support a similar but smaller range of organisms to those found at nearby Spurn.

In 1986, 1989, 1997 and 1998 biological surveys of the lagoons were conducted and the results (Sheader & Sheader, 1999) showed that they supported a mixture of marine and specialist lagoon fauna and flora: *Chaetomorpha* sp. and *Ruppia cirrhosa* (macrophytes), *Conopeum seurati* (Bryozoa), *Hydrobia ventrosa* and *Cerastoderma glaucum* (Mollusca), and *Corophium insidiosum*, *Idotea chelipes* and *Palemonetes varians* (Crustacea). Because of the infrequency of the coastal lagoon type of habitat, this assemblage and its individual members are necessarily scarce in Britain. The main threat to this flora and fauna at Beacon Lagoons is the erosion of the beach by the North Sea, which ultimately threatens the entire site with 'coastal squeeze', first making the lagoons tidal and ultimately eliminating them altogether as the beach retreats to the foot of the embankments. It is expected that the southern extension will acquire a similar aspect to the present lagoons as coastal erosion proceeds, prolonging the life of the habitat and its associated biota.

Adjacent to the South Lagoon is an area of non-tidal saltmarsh (see Cook, Fig. 2, this issue, p. 109), which has been continuously present, though not necessarily in exactly the same place, for at least a century. It has outlasted the similar saltmarsh adjacent to the Humber at the 'Chalk Bank' and 'Wire Dump' stretch of the Spurn Peninsula (Denton, 1995). In 2003, the mirid bug *Orthotylus rubidus* was found in the part of the South Lagoon marsh dominated by *Salicornia* and *Suaeda* (Dolling, 2003). This insect has the national conservation status RDB3 (rare) (Kirby, 1992) and is a Biodiversity Action Target species (Anon, 1999). It is closely associated with the halophytes mentioned and cannot withstand regular inundation by the sea, thereby restricting its range to non-tidal saltmarsh. The known range in 1999 was cited as three sites in Norfolk and one each in Dorset and Sussex, with historical records also from Devon, Hampshire, Kent, Essex and Suffolk. Its presence at this Yorkshire site therefore constitutes a considerable extension of its known range. Maintenance of non-tidal saltmarsh at this site is, therefore, a high priority for its conservation nationally.

The dunes support the latridiid beetle *Melanophthalma curticollis*, which is accorded national conservation status RDBK (Hyman & Parsons, 1994), indicating that it is insufficiently well known to make any precise assessment of its frequency. It is markedly xerothermic, occurring at the base of plants on light soils at four known British sites (Johnson, 1986). Beacon Lagoons is very close to its known station at Spurn and perhaps should not be regarded as an additional site. It is interesting to note that both *M. curticollis* and *Orthotylus rubidus* occur at Salthouse in Norfolk. The rare (RDB3) corylophid beetle *Orthoperus brunnipes*, with habits similar to those of *M. curticollis*, has also been recorded from Beacon Lagoons and the Notable (B) ground beetle *Pogonus littoralis* was reported here on its first occurrence in Yorkshire (Kenington, 2004).

The quality of the Beacon Lagoons site is further underlined by the presence of several more beetles and a bug with national conservation status Notable (B). These include the capsid bug *Trigonotylus psammaecolor* of dune grasses, and the aquatic beetles *Helophorus griseus* in a freshwater pond, *Helophorus fulgidicollis* in temporary pools in the former agricultural land, and *Ochthebius marinus*, *Enochrus bicolor, Cercyon ustulatus* and *Haliplus apicalis* in brackish waters. *Atomaria rhenana* and *Carpelimus foveolatus*, classed as Notable species, found in the tidal saltmarshes of the Humber, also occur in the

non-tidal marsh at Beacon Lagoons. The diving beetle *Agabus conspersus* and the ground beetle *Lasiotrechus discus* have also been recorded.

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BOOK REVIEW

The Life and Death of Planet Earth by **Peter Ward** and **Donald Brownlee**. Pp. xii + 240, including b/w illustrations. 2007. Piatkus, London. £8.99 paperback.

This is an interesting book in that, unlike most books on the history of the planet, this one looks to its future rather than its past history. The authors try to trace possible scenaria for the future development and final demise of the planet. They come to the conclusion that to a large extent history will be repeating itself, but in reverse. Although the conclusions are not startling it is interesting to have them put before us – even though the time scales involved are such that the human race will not be affected by the events they describe. Although some future biological changes are mentioned, the fact that neither author is a biologist is apparent in their prognostications. There is a reasonable bibliography but several references to workers in the field are not listed in the reference list at the back which is rather frustrating. In spite of this it is an interesting read, if only because it will make the reader realise that whatever we humans do, it will have no impact on the ultimate fate of this planet – i.e. it will die and be destroyed.

Printed in Great Britain by Titus Wilson & Son, Kendal ISSN 0028-0771

October-December 2008 Number 1067
Volume 133

The Naturalist

A QUARTERLY JOURNAL OF NATURAL HISTORY FOR THE NORTH OF ENGLAND

The Harbour Porpoise (*Phocoena phocena* Linn.) in Inland Tidal Water Bodies in Yorkshire, Humber and Adjacent Regions – *C. A. Howes*

The Nineteenth Century Excavation of Helsfell Fissure near Kendal, Cumbria, and a Reassessment of the Surviving Bone Assemblage – *Hannah J. O'Regan, Tom Clare and David M. Wilkinson*

Botanical Report for 2008: Flowering Plants and Ferns – *P. P. Abbott*

Yorkshire Naturalists' Union Excursions in 2007 – *Albert Henderson and Adrian Norris*

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THE HARBOUR PORPOISE (*PHOCOENA PHOCOENA* Linn.) IN INLAND TIDAL WATER BODIES IN YORKSHIRE, HUMBER AND ADJACENT REGIONS

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Introduction

The occurrences of cetaceans in the waters of Watsonian Yorkshire and adjacent areas have been periodically collated and reviewed in county oriented publications, notably Clarke and Roebuck (1881), Smith (1905), Carr (1906), Grabham (1907), Blathwayt (1912), Spalding (1966), Delany (1985), Howes (2000) and currently the YNU Website. Today, when biodiversity monitoring crucially underpins local and national wildlife conservation strategies, cetacean recording is spread across the disparate printed and electronic output (journals and websites) of an expanding range of local, regional and national cetacean recording, sea mammal rescue, marine studies, sub-aqua, veterinary, natural history, bird watching, media and even tourism and lifestyle organisations. Inconvenient though this may be, it encouragingly reflects a lively interest in the subject and provides recording forums for those not associated with formalised scientific recording.

This study seeks to collate data from these disparate and potentially ephemeral sources with a view to producing an analysis of the little known and poorly understood phenomenon of harbour porpoises (*Phocoena phocoena*) utilising inland tidal water bodies in the Yorkshire, Humber and adjacent regions.

Human Exploitation of Cetaceans in Estuaries and Tidal Rivers

Excavations of an Anglo-Saxon (7th-10th century) site at Flixborough, North Lincolnshire, has revealed evidence of the 'harvesting' of Bottlenose Dolphins (*Tursiops truncatus*) from the adjacent Humber estuary (Hoelzel 2007). From the Middle Ages, stranded cetaceans were legally classified as 'Royal Fish' and belonged to the crown. Certain riparian landowners and clerics claimed these rights for themselves in accordance with what they described as ancient practice but were forced to have the basis of these claims investigated in the 'Quo Warranto' courts held between 1279 and 1281. Records of these hearings provide evidence of strandings taking place between the time of the Norman Conquest and the late 13th century in Yorkshire's coastal and estuarine waters (English 1996).

Originally, cetaceans that were caught or found stranded provided a source of meat, oil and other products (Evans *et al.* 2008). Up to at least the 14th century, harbour porpoises were caught for food, though in the 19th century bounties were offered by fisheries interests to encourage their slaughter due to a perceived threat to commercial salmon stocks.

Bycatches (animals incidentally caught in a variety of fishing gear) have been identified as the main cause of mortality (at least 28%) of stranded porpoises in England and Wales (Kirkwood 1997) and the fixed nets for salmon have historically accounted for numerous Humber fatalities. The effects of industrial pollutants such as PCBs is not known but PCB concentrations in many British stranded porpoises (1989-2002) were high enough to cause adverse physiological effects in other mammals (Evans *et al.* 2008).

Legislative Protection

Cetaceans are currently protected under a range of European and UK legislation; for instance, the harbour porpoise, listed as 'vulnerable' by the International Union for the Conservation of Nature (IUCN), is protected under Schedule 5 of the Wildlife and Countryside Act (1981), it is listed in Appendix II of CITES, Appendix II of the Bern Convention and Annexes II and IV of the EC Habitats Directive. It is also on Appendix 2[b]

of the Bonn Convention and is covered by the terms of the Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas (ASCOBANS).

The EU Habitats Directive (92/43/EEC of May 1992 on the Conservation of Animal and Plant Species of Community Interest) is a legislative instrument that seeks to achieve conservation goals for its target species. In addition, the ASCOBANS agreement obliges signatories, including the UK, to apply a range of research and management measures aimed at the conservation of all cetaceans.

In 2007, the UK Government was found to be in breach of its duties under the Habitats Directive with regard to cetacean conservation. Consequently greater rigour in population monitoring and conservation enforcement was required to ensure harm or disturbance was avoided.

Due to the current legislative situation, statutory bodies such as the Environment Agency, Port authorities, British Waterways and riparian local authorities need to know about the cetaceans which enter their jurisdiction. More particularly they need to be aware of the effects on these creatures of fishing practices, river management and other engineering activities such as drilling and blasting.

Geographical Review of Harbour porpoise occurrences

In order to provide statutory bodies in the Yorkshire and Humber, Cleveland, North Lincolnshire and Nottinghamshire regions with preliminary evidence on which to base cetacean conservation policies and practices, the following review provides a chronological catalogue of sightings and strandings in tidal river systems associated with the Tees, Esk and Humber catchments; Figure 1 maps the recorded occurrences.

River Tees

The Curistors Rolls (1530) make reference to the regulation of the fisheries in the Tees in which '... purpose ... and other like fishes' are mentioned (Brewster 1796). Porpoises are abundant in the sea at the mouth of the river and frequently enter and are sometimes captured in the in the river". One was seen in the river quite recently (1880s) and efforts were made to capture it but without success" (Lofthouse 1887).

A survey of the manor of Stockton made in 1647 states that the Bishop of Durham had royalties of the Tees, whales ... and porpoises, within the manor (Page 1928).

On 6 January 2000, one was stranded at the Tilcon plant on the south bank of the Tees estuary, Middlesbrough (Nat.Hist.Mus.) and one was in the Tees opposite Smith's Dock (NZ/5020) on 18 February 2007 (Mike Leakey) and on 21 February, three were seen at Saltholme (NZ/5021) (Sylvia Brennan).

Esk Estuary

On 7 May 1974, one was stranded alive but with a badly cut tail fluke on Tait Hill Sands in the Esk estuary (NZ/8910) (Delany 1985).

Humber

In 1876, porpoises 'in great quantities' had occurred in the Humber 'between Cleethorpes and Goole. Some [schools] had been calculated to number four and five hundred ...' (*Doncaster Gazette* 1876). Referring to the early years of the 20th century Grabham (1907) asserts that porpoises 'frequently follow the salmon up the Humber'.

One of a 'school' of porpoises was foul-hooked by an angler at Stallingborough (TA1915) in March 1924 (Anon. 1924). Although porpoises clearly passed through the Humber to ascend the tributaries, notably the Ouse, documented records do not appear regularly until the late 1950s. On 4 January 1958, one was stranded on the Humber bank at Welton (SE/9624) (Hazelwood 1959). On 15 June 1969, one was seen in the estuary off Hull (TA/1027) (*Hull Daily Mail* 1969). On 31 March 1976, one became fatally trapped in the King George Dock (TA/1428) (*Hull Daily Mail* 1976). On 24 January 1986, one was fatally stranded on the Skeffling Clays (TA/3618) (South Holderness Countryside Society).

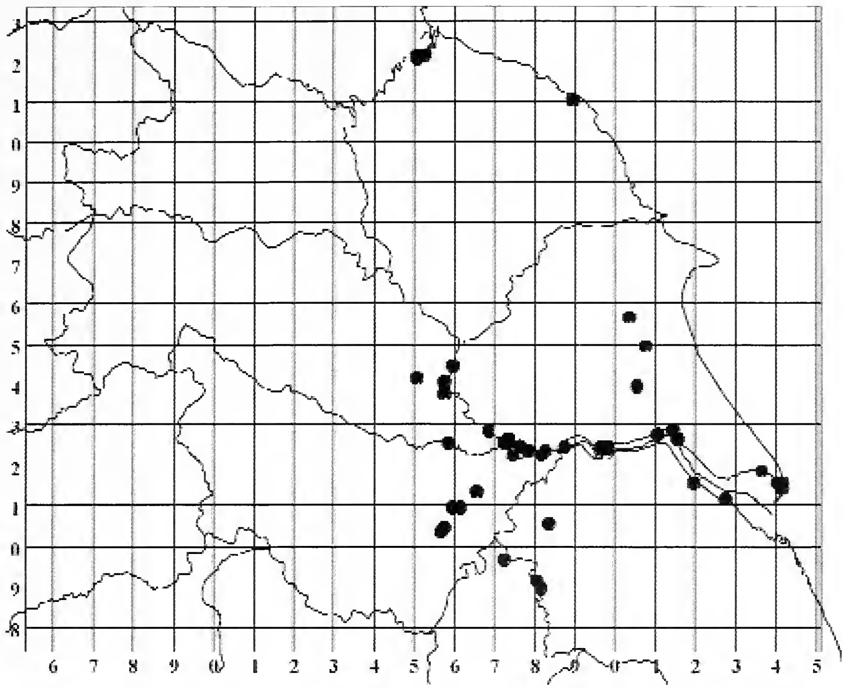

FIGURE 1.
Harbour Porpoise in estuaries and tidal rivers.

On 13 March 1990, one became fatally trapped in the King George Dock (TA/1428) (South Holderness Countryside Society). Three porpoises which had been present 15 miles upstream of Hull for two weeks, were temporarily stranded on Whitton Sands (SE/8724) on 7 April 2003 (Sue Rhoades, British Divers Marine Life Rescue). On 8 April 2004, one stranded 180m out from the shore near Saltend Jetty (TA/1526) was re-launched and swam off strongly (Simon Drayton, British Divers Marine Life Rescue). On 10 April 2008, two were sighted off The Deep, Hull (TA/1027) (Sarah Bellard, Seawatch Foundation).

River Hull
On 17 May 1909, at least four entered the River Hull, one reaching Hempholme Lock (TA/0749), three reaching Beverley (TA/0539), and one being shot in Milka Dyke (Foster 1909, Spalding 1966). In April 2005, one was stranded in the River Hull near Driffield (TA/05) (Ray Eades *pers. comm.*).

River Ouse
The 'Quo Warranto' Court Rolls of 1279 to 1281 record cases where stranded whales were claimed from the waters of the Ouse at Ousefleet (SE/8223) by Walter de Ouseflet, in the vicinity of Howden (SE/72) by the Bishop of Durham, and in the demesne of Selby (SE/63) by the Abbot of Selby (Howes 1998).

Locally obtained porpoises were evidently readily available to be feasted upon at prestigious noble and ecclesiastical banquets in the 15th and 16th centuries. Clarke and Roebuck (1881) note that in 1466 at the great feast held in the archiepiscopal palace at

Cawood on the occasion of the enthronement of George Neville, Chancellor of England as Archbishop of York, 12 porpoises and seals were consumed, and in 1526, 13 shillings and 4 pence was paid for porpoises to be feasted upon at the banquet to celebrate the wedding of a daughter of John Neville, High Sheriff of York. It is likely that during this period, most porpoises would have been caught incidentally by the Ouse salmon-netsmen, notably at Goole, Howden and Cawood.

In the late 19th century, commercial fishing interests became concerned at the perceived damage caused by porpoises to fish in the Ouse off Goole. 'It was resolved at a meeting of commercial fishing interests that bounties of 10 shillings each was to be offered for the first 20 specimens of Grampus* caught and 5 shillings each for the first twenty porpoises (*Doncaster Gazette* 24 November 1876).

During the first week of August 1877, 'a great number of ... porpoises were observed near Whitgift' (SE/8122), and it was claimed that the Ouse Salmon fishery had suffered from 'enormous destruction of the fish' evidently caused by 'grampuses and porpoises which constantly visit the Ouse and the other tributaries of the Humber' (*Goole Times* 1877). Great numbers were alleged to follow the salmon up the Humber system, sometimes ascending the Ouse as far as Cawood (SE/5737) (Clarke & Roebuck 1881).

Circumstantial evidence of porpoises predating the in-coming salmon was that several salmon taken at Naburn (SE/5944) had 'gaping wounds in their backs and teeth marks plainly visible along their sides' (Grabham 1907). On 16 May 1906, a small specimen examined by Grabham (1907) was taken in the salmon nets in the Ouse just below the dam at Naburn. Other Naburn records are of one shot on 4 February 1915 (Smith 1915), another shot on 9 September 1926 (Smith 1927), and two shot on 11 February 1938 (Gallway 1939).

On 26 April 1934, one was shot in the Ouse at Stillingfleet (SE/5740) (Bramley 1935). In 1959, one ascended the Ouse to Goole (Hazelwood 1961) and in 1973 one stranded on the tidal mud at Hook railway bridge (SE/7624). Two were present in the Ouse off Goole Docks (SE/7422) in December 1996 (Chris Firth *pers.comm.*) and an adult male stranded on the tidal mud at Reedness (SE/7823) on a particularly high tide on 8 January 1997 (C. A. Howes).

Porpoises ascended the river to Cawood on 16 March 2003 to the delight of a crowd of people who watched them from the swing bridge (SE/5737). Sue Miles, a resident of the village for 28 years, recalls three or four occasions when porpoises have been seen in the river – usually between the bridge and the church. She said: "They don't come every year but when they do the older people in the village seem to think that they are following the migration of salmon up the river" (*Yorkshire Post* 2003).

At Whitgift (SE/8122) on 15 May 2007, a porpoise passed on the flood tide about mid-tide, 'porpoising' and moving across the main channel, although generally moving upstream with the tide (Cutts 2007), and on 13 September 2007 one was at the Barnby Tidal Barrage at the confluence of the Derwent and Ouse (SE/6828) (Martin Fuller *pers. comm.*).

River Wharfe

Porpoises following the salmon up the Humber system, sometimes ascended the Wharfe to Kirby Wharfe (SE/5041) (Clarke & Roebuck 1881).

River Aire

Grabham (1907) notes that 'they have been shot in the River Aire as far inland as Chappel Haddlesey' (SE/5825).

An absence of records up to the mid-1990s may be due to gross pollution eradicating

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* It is difficult to know what is referred to by the name of 'grampus' but larger odontocete such as Bottlenose Dolphin *Tursiops truncates*, Killer Whale *Orcinus orca* or Long-finned Pilot Whale *Globicephala melaena* have all been recorded in the Humber catchment.

migratory fish stocks. During early December 1996, porpoises were suspected to be in the river near the confluence of the Ouse and the Aire (SE/7226) where Environment Agency staff reported 5-6 salmon 'porpoising' out of the water, evidently being pursued by some form of unseen underwater predator (Chris Firth *pers.comm.*). In late April 2001, 'porpoises were seen in the tidal part of the river, presumably feeding on the increasing fish stocks' (*Yorkshire Evening Post* 2001). In April 2005, two Environment Agency officers reported close views of two porpoises surfing the bow wave* of a stoning boat on the lower Aire. Evidently the boat crew were used to encountering porpoises here and enquiries of other people who work on the tidal sections of the Ouse and Aire showed porpoises were regularly seen in the river (Martin Fuller *pers.comm.*).

River Don

The diary of the Rev. Abraham de la Pryme records that in 1687 a porpoise was caught in the Don at Fishlake (SE/6513) and was 'carried about for all to see'. In October 1897, one ascended the Don to Doncaster (SE/5704), its skull being preserved in Doncaster Museum (Howes 1984). During the first week of September 1922 one was shot at Barnby Dun Bridge (SE/6109) (*Doncaster Gazette* 1922), and on 3 June 1983 a porpoise calf ascended the Don to Doncaster (SE/5704) but was 'rescued' and returned to the sea (Howes 1984).

River Eaubeck (a tributary of the Don)

On 5 December 1996, a porpoise which had ascended the River Don to Kirk Bramwith (SE/6111) entered the River Eaubeck near Thorpe Marsh Power Station and was observed in the river at Thorpe Marsh Nature Reserve (SE/5909). The specimen was watched for some minutes (surfacing and diving) (Eric Denby *pers.comm.*).

River Idle (a tributary of the Trent)

On 24 May 1967, one was found dead in the Idle at Idle Stop (SK/7296) (Howes 1983).

River Trent

Carr (1906), reviewing occurrences in the Trent, regarded porpoises as 'once very frequent in the tidal portion', noting that 'on half a dozen occasions during the past ten or twelve years [1894 to 1906] small schools had ascended as far as Collingham' (SK/8161). In 1880, when the river was in flood, a school of five crossed the weir in the canal just below Newark (SK/8055). In about 1898, five were killed near Collingham and on 26 March 1903 one was shot at Kelham (SK/7756) near Newark' (Carr 1906). In 1891, three were shot in the Trent at West Butterwick (SE/8305) (Peacock 1901).

One was seen in the Trent at Morton (SK/8091) in August 1971 (*Doncaster Evening Post* 1971) and in January 1999 two were watched by crowds of onlookers at Gainsborough (SK/8189) (Yorkshire Television).

CHANGES IN STATUS AND SEASONALITY

In order to reveal historical changes in patterns of occurrence, records from all the target estuaries and tidal river system have been aggregated for each decade from the 1870s to the present (see Figure 2). Anecdotal evidence indicates that the harbour porpoise was hugely abundant during the 1870s and 1880s with a significant decline indicated into the early decades of the 20th century. One can only speculate as to the causes of this but the issuing of bounty payments for their slaughter (*Doncaster Gazette* 1876 etc.) and the deterioration of water quality from industrial rivers exterminating salmonid fish populations are likely factors. Their effective absence from the 1910s to the 1970s virtually removed them from folk memory and official consciousness. Following the implementation of water pollution legislation and the demise of much of the regions' heavy industries, there has been a rapid

* This behaviour is not typical of porpoise, but characteristic of bottlenose dolphin which occasionally visits the Humber and its tributaries.

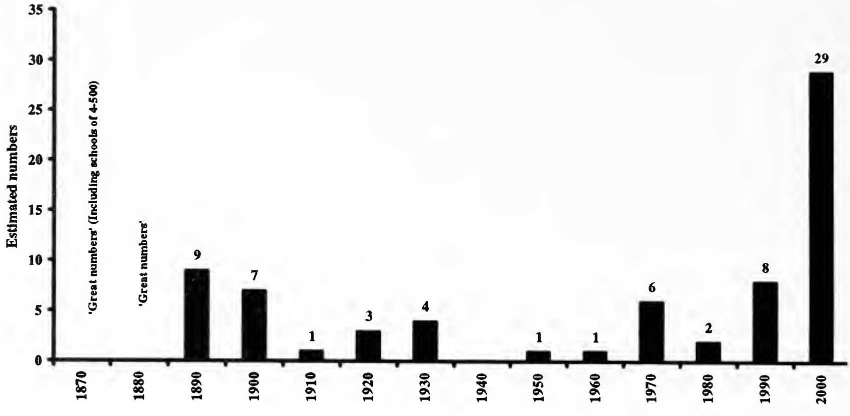

FIGURE 2.
Changing status of Harbour Porpoise in Estuaries and tidal rivers from Tees to Humber.

and very remarkable improvement in the water quality in all of the major industrial tidal river systems. This has enabled the restoration of self sustaining fish stocks which in turn has supported the establishment of an associated predator prey ecology as illustrated by the contentious rise of inland feeding and breeding populations of the Great Cormorant (*Phalacrocorax carbo*) (Howes 2003). The improved conditions have led to the restoration of seasonal runs of migratory salmonid species (Howes & Kirk 1991, Howes & Firth 2003), a phenomenon that coincides with the modest but significant rise in porpoise occurrences over the past three decades.

Figure 3 shows that the seasonality of occurrences of harbour porpoise in the Tees, Esk and Humber estuaries and the tidal reaches of their tributaries peak in late winter and spring, coinciding with river spates which enable inwardly migrating salmonids to pass upstream.

This appears to confirm 19th century anecdotal claims and local folklore that porpoises were utilising this seasonal migration. Interestingly this pattern is in contrast with coastal records of sightings and strandings which peak during August and September which is likely to be associated with migratory movements of inshore spawning shoals of Mackerel

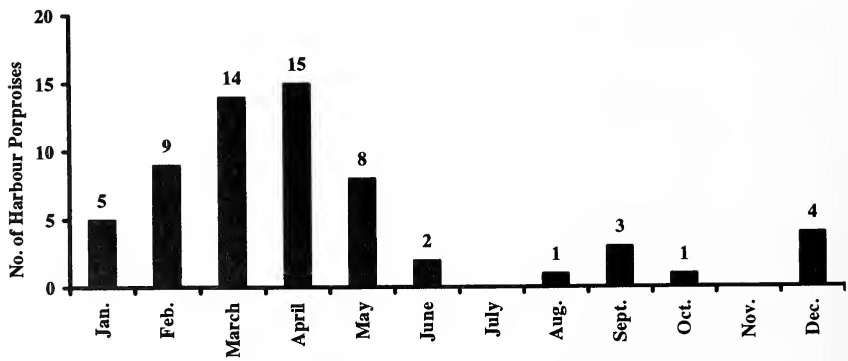

FIGURE 3.
Seasonality of Harbour Porpoise in Estuaries and tidal rivers from Tees to Humber.

(*Scomber scombus*) and Herring (*Clupea harengus*) and the timing of porpoise breeding behaviour (Howes in prep.).

Since calves are borne from May to August, peaking in June, and mating peaks in July and August, there is little evidence in either Figure 3 or 4 that harbour porpoises use the sheltered conditions of estuarine waters for mating or parturition. Figure 4 shows the size ranges of the 13 Humber catchment specimens for which length measurements are available. Comparing this data with the size ranges of newborn calves and fully adult males and females (Evans *et al.* 2008) suggests that the Humber estuary and its tributary rivers may be functioning as a seasonal nursery, the majority of specimens (69%) being growing calves and immature animals with a smaller number of fully adult specimens.

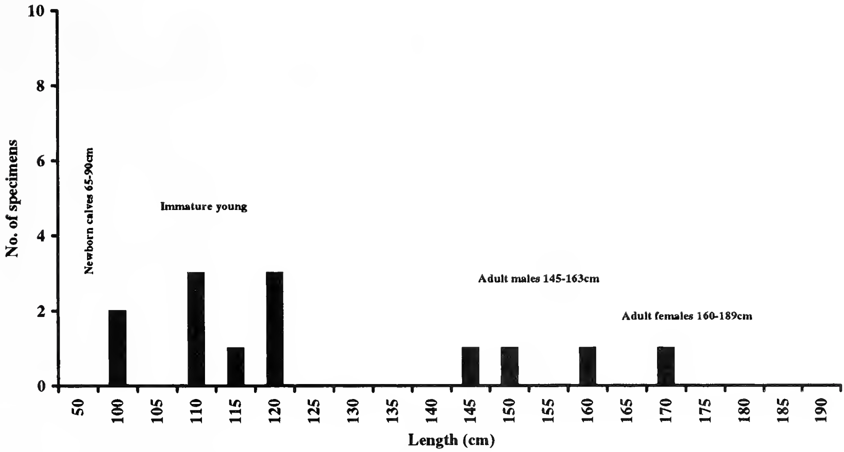

FIGURE 4.

Size ranges (cm) of Harbour Porpoises measured in the Humber catchments (n=13).

This study illustrates how the local harbour porpoise population has historically been under pressure from a variety of anthropogenic sources. In accordance with current legislation, practical conservation practices are being developed through local Biodiversity Action Plans. To date, Harbour porpoise Action Plans have been developed by the local authorities of Anglesey, Argyle and Bute, Durham, Ceredigion, Cheshire, Cornwall, Denbighshire, Essex, Neath-Port Talbot, Norfolk, North-east Scotland, Pembrokeshire, Suffolk and Swansea. This study is presented as a basis for equivalent local Biodiversity Action Plans to be formulated for appropriate statutory bodies in the Yorkshire, Humber and adjacent regions of the north east of England.

ACKNOWLEDGEMENTS

I would like to thank Chris Firth, Martin Fuller and Paul Frear of the Environment Agency, Leeds for anecdotal records and to Martin Limbert and Andrea Marshall for locating records in 19th and early 20th century local newspapers.

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THE NINETEENTH CENTURY EXCAVATION OF HELSFELL FISSURE NEAR KENDAL, CUMBRIA, AND A REASSESSMENT OF THE SURVIVING BONE ASSEMBLAGE

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ABSTRACT
Helsfell Fissure, near Kendal, was excavated during the 19th century and produced a large collection of animal bones which were influential in contemporary histories of the vertebrate fauna of the area. Material reputed to be from this cave is now stored in three museums in North West England; however, a study of the history of the assemblages suggests that only the material in the Ruskin Museum Coniston has good provenance. A reassessment of this material shows that bones previously identified as belonging to wild animals or humans are actually of domestic species. The history of these collections suggests caution in the use of nineteenth century species lists of remains from caves and other deposits in studies of the history of the British vertebrate fauna and the uncritical acceptance of provenance data on such material in museum collections.

INTRODUCTION

The site of Helsfell fissure (also known as Helsfell cave, grid ref.: SD 501936), near Kendal, Cumbria, was excavated between 1880 and 1885. The only contemporary publication on the dig and its finds was by Macpherson (1892), who used this site as his principal source of information on the history of the vertebrate fauna of Cumbria, in his book on *A Vertebrate Fauna of Lakeland*. The site has been linked to three major names in 19th century British palaeontology – William Boyd Dawkins, Richard Owen and Richard Lydekker, all of whom are said to have identified the bones recovered during the excavation. This assemblage is reputed to have contained bear, wolf and pika remains (see Table 1 for scientific names of wild species), as well as a variety of other taxa (Macpherson, 1892; Jackson, 1953; Fisher & Yalden, 2004). The presence of bear has been noted by a number of authors and the extinction of this animal in the British Isles is a matter of great interest. In addition, the pika is a lagomorph adapted to cold conditions and found in British late glacial assemblages, potentially extending the history of the cave back to the Younger Dryas (Fisher & Yalden, 2004). The cave is also of potential archaeological interest as the assemblage is reputed to have included a bone point (Macpherson, 1892), and a human skeleton (Chamberlain & Williams, 2001). This little known assemblage is therefore worthy of note, both for the insight it brings to the history of cave excavation in Northern England, and also the potential importance of its contents to our understanding of the history of the British mammal fauna.

This paper is in two parts, the first comprises the history of the excavation, and the subsequent fate of the assemblage, whilst the second half is a brief archaeozoological analysis of the material that can still be confidently considered to have come from Helsfell fissure.

THE HISTORY OF HELSFELL – EXCAVATION AND CURATION

One area in which all sources agree is that the cave was excavated by Mr John Beecham of Kendal, who was a Master Chairmaker born in 1815 at Plumgarth in the Parish of Strickland Ketel and subsequently lived with his wife and family in Shaw's Brow (now Windermere Road) in the north of Kendal (see Figure 1). Both Plumgarth and Shaw's Brow were only 15-20 minutes walk from the cave, so it is likely that he knew of the site from an early age.

TABLE 1.

Common names and binomials of wild animals mentioned in this paper – in some cases it is impossible to be sure which species was being referred to when only a common name was used in an early publication.

Common name	**Scientific name**
Pika	*Ochotona pusilla*
Wolf	*Canis lupus*
Fox	*Vulpes vulpes*
Red Deer	*Cervus elaphus*
Bear (brown, grizzly)	*Ursus arctos*
Irish elk (giant deer)	*Megaloceros giganteus*
Mole	*Talpa europaea*
Otter	*Lutra lutra*
Rabbit	*Oryctolagus cuniculus*
Badger	*Meles meles*
Rat	*Rattus* sp.
Roe deer	*Capreolus capreolus*
Hedgehog	*Erinaceus europaeus*
Wild cat	*Felis silvestris*
Boar	*Sus scrofa*
Pine marten	*Martes martes*
Buzzard	*Buteo buteo*
Greylag Goose	*Anser anser*
House mouse	*Mus musculus*
Short-tailed field mouse (Field Vole)	*Microtus agrestis*
Polecat	*Mustela putorius*
Mammoth	*Mammuthus primigenius*

There was a surge of interest in cave archaeology in the late 19th century following the discovery of early human remains from caves around Torbay and in France (Lyell, 1863; Dawkins, 1874; Van Riper, 1993), and this may have encouraged him to begin to excavate the site. Our knowledge of the course of this excavation is entirely restricted to the account provided in Macpherson (1892) in which he says in a footnote "In describing the Helsfell deposits, I am giving information supplied to me by Mr. Beecham himself" (p. xli). From this account it seems the excavation was begun around the summer of 1880 when Beecham was in his 60s, and except for the aid of a neighbour on one evening to help move clay from the cave entrance, Beecham worked alone. "He revealed his intentions to no one, but worked on with dogged pluck for five continuous summers, only suspending his self-chosen task when he reached fissures which could not be opened without blasting." This section provides the only description of the cave itself, in which fissures (note the plural) are described, being around 20 feet long, and with one deep fissure 20 yards from the cave entrance which contained amongst the pebbles and fine clay "the most important remains". The description given by Macpherson (1892) of the cave as 'fissures' does not seem to match the cave currently known as Helsfell fissure, as the entrance is a single crawl, with two passages inside (Brook *et al.*, 1994; *pers.obs.*). However, the side passage is blocked by

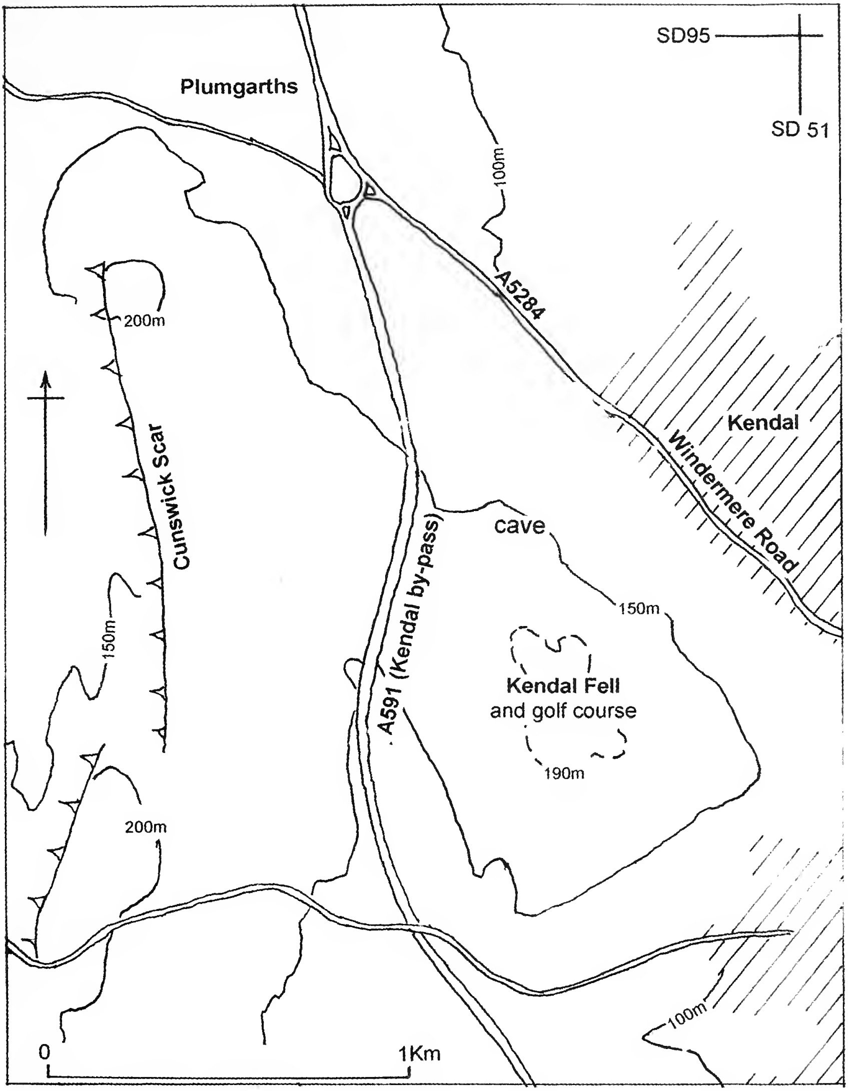

FIGURE 1. Map of the area around Helsfell Cave, Kendal.

flowstone (Brook *et al.*, 1994) and the entrance gives the impression of having been quarried, so the original entrance and other fissures may have been lost since Beecham's day. There are no other caves reported from the Helsfell area.

The faunal list reported by Macpherson is shown in Table 2. Beecham's excavation methods are also described, saying that no levels were taken, but that each bucket of cave earth was washed in a nearby stream to recover small animal remains. Taking such care to

recover microfauna was quite innovative for the time; for example, there is no mention of washing sediments in the instructions 'On the instruments and methods of cave hunting' in the standard contemporary text (Appendix 1 of Dawkins, 1874). Macpherson also notes that "When Beecham completed his labours, the bones which he had found were identified by Boyd Dawkins" and that "After his specimens had been identified, Beecham desired that a complete series of them should be placed in Kendal Museum. This was accomplished by their purchase, and they now form the most interesting exhibit of those possessed by the Kendal Literary and Scientific Institution". The only suggestion of archaeology from within the cave is on page xlix where it says "a bone arrow-head was found in the Helsfell fissures", but there was no mention of human bones; archaeology, however, was clearly not the focus of the book.

In an attempt to check and expand on Macpherson's account, we have examined the Kendal newspapers and archives for the period 1880-1892 to verify the information as presented. This has provided further insight into the activities of local societies at the time and the fate of the Helsfell material. As reported by Macpherson, Beecham worked secretly, a fact borne out by the absence of any record of the cave in the archives until 1886. The first mention we have located is in the minute books of the Kendal Literary and Scientific Institution on 15 March 1886, when "The Rev. Geo. Crewdson and the secretary were requested to see Mr Beecham with the object of securing the animal remains recently found by him at Helsfell, for the museum" (Kendal Record Office: WD/K/207). The same Revd Crewdson gave a lecture to the Kendal Natural History Society on 4 June 1886 (reported in the *Westmorland Gazette* on 16 June 1886) entitled 'a geological ramble', in which he mentioned the Helsfell specimens "which he was glad to say were not to leave Kendal, untill [sic] the museum authorities had had an opportunity of securing them" (WD/K/207).

In September 1886, the Cumberland and Westmorland Antiquarian and Archaeological Society (CWAAS) held its annual meeting and second field excursion in Kendal and Shap, and the proceedings were published in the society's journal (*Transactions of the Cumberland and Westmorland Antiquarian and Archaeological Society*). At this meeting, John Watson laid before the society a paper entitled "Extinct Animals-Helsfell Bone Cave" and both Mr Watson and Mr Beecham are reported to have been present at the meeting (reported in *Transactions of the CWAAS* **9**: 152 & 156). Unfortunately the paper on Helsfell was not published in these *Transactions*, but a brief report appeared in the *Westmorland Gazette* on 11 September 1886: "Mr J. Watson read a paper on The Extinct Animals of the Lake District, as illustrated by the remains found in the Helsfell bone cave. At the close of the reading of the paper, Mr. Titus Wilson [of the publishing firm which still publishes *The Naturalist*] suggested that the exertions of Messers Beecham and Simpson at the Bone Cave should be recognised and the further exploration taken up by that or some other society". This is an interesting statement, as Macpherson explicitly reports that Beecham worked alone, yet a Mr Simpson is also reported to have been present. It is possible that Mr Simpson was the 'neighbour' referred to by Macpherson who helped Beecham open the cave at the start of the excavation, but this cannot be verified. Having presented his work at the archaeological society meeting, Mr Watson also gave a talk on "caves and cave contents" to the Kendal Literary and Scientific Institution on 20 December 1886. The following year he is listed as a curator of the Literary and Scientific Institution's Museum (WDK/195/2) and is mainly known today as the author of a number of papers on aspects of the ornithology of the Lake District (Ratcliffe, 2002).

In 1886, the site had clearly become well known in Kendal, and negotiations were underway to gain the collection for Kendal Museum. However, in September 1886 the Kendal Literary and Scientific Institution minuted that they were £220 in debt and had initiated a letter writing campaign to secure more funds (WDSO/4). The minutes of 9 September 1887 state that "Mr Beecham having pressed for some decision as to the purchase of the animal remains found by him at Helsfell, the secretary was requested to write to Mr Beecham, asking him for some definite offer". At this same meeting it was announced that the society had managed to balance its books owing to "exercise of due

TABLE 2.

Fauna from Helsfell reported in Macpherson (1892) and reputed to have been identified by W. Boyd Dawkins (* indicates those identified by R. Lydekker), fauna on display at Kendal Museum as reported in the 53rd annual report of the Kendal Literary and Scientific Institution (1888), reputed to have been identified by R. Owen and Mr Plant, fauna listed in the catalogue of Kendal museum (1935) and fauna listed in the Coniston catalogue (1919).

Kendal Report (1888)	Macpherson (1892)	Coniston (1919)	Kendal Museum (1935)
Man	A bone point	Human and young child	
Horse	Horse	Horse	
Fossil horse			
	Bos longifrons	*Bos longifrons*	
		Bos (extinct species)	
Ox		*Bos*	
Dog		Dog	
Pig		Hog	
Otter	Otter		
Mole			
Rabbit	Rabbit		
Martin	Pine Marten		
Badger			
Rat			
Wolf	Wolf	Wolf	Wolf
Fox	Fox	Fox	
Deer			
Roe deer	Roe		
Red deer	Red Deer	Stag	
Hedgehog	Hedgehog		
Wild Cat	Wild Cat		
Boar	Wild Boar		
Various birds	Buzzard*		
	Goose*		
	Fowl*		
	Sheep	Sheep or goat	
	Goat	Young kid	
	House Mouse		
	Short-tailed Field Mouse		
	Bear	Grizzly bear	
	Polecat or Foumart		
		Ruminant teeth	Other bones

economy in the year upon which we have just entered". Unfortunately for Mr Beecham, with the Society only just recovering from financial difficulties, this was not a good time to be attempting to sell the Society anything, and when his reply came back on 19 September 1887 with a request for £40 for the entire collection "It was decided to decline purchasing them but the curators were empowered to spend a sum not exceeding 5£, so as to to [sic] secure some of them for the museum" (WD/K/207). A report in October indicates that discussions were still ongoing, and matters had been left in the hands of the curators (one of whom was John Watson). These discussions must have been completed by 17 September 1888 as the 53rd annual report of the Kendal Literary and Scientific Institution stated that "Special reference must, however, be made to an addition which has, by the kindness and liberality of several gentleman, been made to the contents of the museum. It will be remembered that, in a sort of cave, or, more properly speaking, fissure on Helsfell, a large accumulation of animal remains of great age was discovered by Mr Beecham of this town. A selection of these, representing the remains of more than twenty different animals, has been purchased and presented to the society. They have been arranged in a case in the "Animal Room". Among the animals represented are man, the horse, the fossil horse, the ox, dog, pig, otter, mole, rabbit, martin, badger, rat, wolf, fox, deer, roe deer, red deer, hedgehog, wild cat, boar and various birds. Most of the specimens have been named by either Professor Owen or Mr Plant, of the Salford Museum" (WD/K/195/2).

This is the first mention of human remains having been recovered from the site, and the last mention of Helsfell in any of the local news or society papers. This leaves several questions, including: who really did identify the material, what happened to the collections after 1888, and were human and bear remains really present?

Who identified the material? Four names have been put forward: Boyd Dawkins, Owen, Plant or Lydekker. The archives of Boyd Dawkins in Buxton and Manchester Museums were examined, but these records are sparse and there was no suggestion that he saw the Helsfell material. According to his diaries held in Manchester Museum, he visited the Lake District in 1880, 1883 and 1891, but did not visit Kendal at any point. Richard Owen would have had to have seen the material between 1880 and 1888; however, he died in 1892, having spent at least the last nine years of his life living in 'relative isolation' in London (Rupke, 1994). Richard Lydekker did see the bird material, as Macpherson records that he sent the specimens to him himself. This just leaves Mr John Plant, Curator and Chief Librarian of the Peel Park Museum, Salford from 1849 to 1892 (Anon., 1892), who wrote numerous papers on fossils from the local coal measures, as well as several papers on the caves of the Peak District. He also published a paper 'On human and animal remains in caves in North Lancashire' (Plant, 1873), which may have brought him local attention. It seems most likely that while correspondence may have occurred with Boyd Dawkins and Owen, Mr Plant probably undertook the majority of the identifications, except for the 11 bird specimens identified by Lydekker.

We know that after 1888 the collection had been split into at least two parts, that purchased and displayed by Kendal Museum and that held privately by Mr Beecham, as Macpherson (1892: lviii) says he found some of the bird bones in Mr Beecham's private collection. John Beecham died on 8 May 1894 in Field Broughton, a village close to Cartmel where the rest of his family lived. There was no mention in his will of the fate of the Helsfell collection. However, in addition to the material held at Kendal (later transferred to Liverpool), there are two other collections which may originally have belonged to John Beecham. These are the remains held at the Ruskin Museum, Coniston, and material from Burneside School donated to Kendal Museum in 1985.

The Kendal Collection

In 1935, a catalogue of Kendal Museum was published which stated that the Helsfell material was on display in two cases "Upright cases. 29. Skeleton of a wolf, found, with other post Pleistocene specimens, in a cavity or rock fissure on Helsfell point, Kendal, by John Beecham, of Kendal, and were purchased from him for the old museum in 1888. In the

cases immediately below this, and numbered ** [illegible] are arranged these specimens, most of which came from Helsfell, found in the same fissure or cavern as the complete skeleton of the wolf in the case above. Human bones excepted". This is where the confusion begins to arise – does 'human bones excepted' mean that the material in the case was from Helsfell, except the human bones displayed? Or that the human bones from Helsfell were not displayed in this case? It is also worth noting that the catalogue only says 'most' of the bones displayed came from Helsfell. The entire geological and palaeontological collection from Kendal, except the wolf skeleton, was sold to the City of Liverpool Museums (now World Museum, Liverpool) in 1960, for the sum of £200 (papers in Liverpool Museum). A typewritten catalogue of this material in Liverpool includes a human skeleton, mammoth and giant deer remains, as well as specimens reputed to come from Helsfell. However, as a letter (dated 17 October 1968) written to J.W. Jackson (Boyd Dawkins' successor at Manchester) by Dorothy Cullen, the assistant keeper of geology at Liverpool attests, there was little provenance with the specimens. She wrote that "the information on the labels accompanying the mammal bones is very poor – none of the specimens are localised and each one is simply labelled "Dog, Quaternary" or "Bear – Quaternary" as the case may be. With such poor data the collection is of little value to us" (Buxton Museum: J.W. Jackson archive 64014). Jackson was able to provide the information that Kendal had possessed material from Helsfell, Whitbarrow and possibly Heathwaite Cave at Arnside (J.W. Jackson archive 64015). With this in mind, and with little or no information on the bones themselves, there is little that can be done with the World Museum, Liverpool collection. We are sure that it does contain Helsfell material, but it may also be mixed with a number of other deposits (see Wilkinson *et al.*, 2006, for a photograph of the differing preservation types) and they cannot currently be separated. There are only two specimens that we feel can be confidently assigned, and these are two tarsometatarsi identified by Lydekker as greylag goose, a diagnosis concurred with by Colin Harrison in a letter dated 31 January 1987 now in the collections of World Museum, Liverpool (specimen number 60.64.BPH for both bones and letter).

The Coniston Collection

The 1919 catalogue of the Ruskin Museum, Coniston Institute, lists a collection of bones as coming from "Helsfell bone cave, near Kendal". The catalogue provides a full list of material including body part and species "Case IV. – Lower Shelf. – Local and other antiquities. Collection of bones of extinct and other animals from Helsfell bone cave, near Kendal:- Humerus, Bos longifrons, broken by a stone weapon; femur (young child); human rib and two other human bones; two jaws (young kid); jaws of fox; five jawbones (sheep or goat); six teeth (ruminants); vertebrae and teeth of wolf, &c; bone of grizzly bear; three bones of dog; two of stag; two of hog; three of Bos; three of wolf; two of Bos, extinct species; two of horse; one bone from foot of Bos (lent by Mr. H.S. Cowper, F.S.A.)" (Ruskin Museum, Coniston: CONRM1989.890.Z). It is probable that this material found its way to Coniston with the help of William Collingwood, the founder of the Ruskin Museum, who was active in Lake District geology (Oldroyd, 2002) and was editor of the *Transactions of the Cumberland and Westmorland Antiquarian and Archaeological Society* for over 20 years. This material has the most consistent provenance of any of the Helsfell material as it has been in the Ruskin Museum since at least 1919 (and it is thought that it would have arrived prior to this).

The Burneside School Collection

The material from Burneside school is now in Kendal Museum and was found during "a big clear out" at the school and donated to the museum in 1985. In a letter dated 17 February 1999, the former Headmaster, Mr Booth, wrote (in a letter to Kendal Museum, which is archived with the bones) 'I presumed they were of Victorian origin and were transferred from the old school to the new about 1965', and 'Unfortunately many of the old school books and records were cleared out and burned'. Therefore there is no definite attribution of

the material to Helsfell, except the fact that the school is very close to both the site and to where Beecham grew up.

In summary, although Beecham excavated the cave diligently and was approached by the local scientific society with a view to obtaining the specimens for their museum, the timing proved unfortunate, as these negotiations began at a time when the society found itself in financial difficulties. Eventually only part of the collection was purchased for Kendal Museum, and that material lost its provenance at some point between 1935 and 1960. The rest of the collection presumably became scattered. Part of the material was obtained by H.S. Cowper and donated to the Ruskin Museum at Coniston where it has remained, while the material from Burneside School has no provenance other than being from a school which was geographically close to the site. Only the Coniston material can be confidently assigned to Helsfell and therefore this forms the majority of the archaeozoological analysis below. The story of the Helsfell collection is an excellent example of what can go wrong with archaeological curation, and particularly with animal bones. While an artefact such as a coin or pot may have an intrinsic worth even when its provenance has gone, for animal bones provenance is everything. It is unfortunate therefore that many early archaeologists tended to write the species or body part directly onto the material, but rarely did they include provenance information.

An analysis of the bone remains

The material held in the Ruskin Museum, Coniston, comprises 50 bones and teeth. The Helsfell material is thought to be the only bone assemblage to have been accessioned by the museum, so it is unlikely to have become mixed with specimens from other sites. The list of taxa represented is shown in Table 3 alongside the list given in the 1919 catalogue. It can immediately be seen that, following our re-analysis of the material, the human and the wild species are no longer considered to be present. Bones marked in ink as ‘human’, ‘grizzly bear’ and ‘deer’ have all been reassigned by us to domestic taxa. The ‘human’ bones consisted of a complete rib (C6/23), two fragmentary vertebrae (C6/24, C6/25) and a femur

TABLE 3.
Coniston material in the 1919 catalogue compared to material present in the collections today. Bones identified as deer and bear are still present in the collection, but they have been reassigned to other taxa (see text for details).

Coniston (1919)	Coniston today
Human and young child	
Horse	Horse
Bos longifrons	Cattle
Bos (extinct species)	
Bos	
Dog	Dog
Hog	Pig
Wolf	?
Fox	Fox/small dog
Stag	
Sheep or goat	Sheep/goat
Young kid	
Grizzly bear	
Ruminant teeth	

(C6/15) marked 'femur of a young chi...' (the last part is unreadable but 'child' is noted in the published catalogue). The femur is from a small canid, either a fox or small dog, while the rib is probably also from a dog. The two fragmentary vertebrae are definitely not human and belong to large (cattle-sized) quadrupeds. The bear specimen has a label pasted onto it saying '*Ursus berox*' and 'grizzly bear', while the bone itself has been marked in pencil 'bear' and 'oxen?'. The specimen is an eroded diaphysis of a tibia, most likely belonging to a young horse (here identified as cf. *Equus caballus*). The deer specimen is labelled '*Cervus elaphus*' and 'deer', but someone has also written 'Ox?' in pencil. It is clearly a complete cattle left metatarsal (Fig 2).

Therefore all wild taxa in the Coniston collection, with the possible exception of wolf (there is certainly a partial maxilla belonging to a large canid in the collection), have been reassigned as domestic species. The human remains have also been reassigned to non-human taxa. It is a similar story with the unprovenanced material from Burneside School (Fig 3), where several specimens have been misidentified. Here the identifications are written on blue card to which the bones are attached, and amongst the sheep/goat material are specimens labelled "human bone" (re-identified by us as a sheep/goat first phalanx), "leg of a wild goose" (cf. roe deer humerus) and "leg of goose or fowl" (juvenile sheep/goat metatarsal). The 'bear' specimens currently on display at Kendal Museum have been re-identified as horse canines. Given that on those bones that are available for re-examination the identifications of humans and other 'exotic' taxa are incorrect, can we trust the other 19th century identifications in the contemporary literature?

What evidence is there for the presence of human remains and bears in Helsfell fissure? Many different authors and sources record that bear bones were present at the site. Yet, the only material identified as bear in the collections still in existence are horse canines and a juvenile probable horse tibia. A newspaper article of 4 December 1886 quoted a talk on British bears at Kendal Literary and Scientific Institution as saying "... a portion of a skull of a bear of this species in the Helsfell crevice". Yet bear is not recorded in the 1888 report of the Kendal collection, although Macpherson (1892: xlvi) states "...Mr Beecham obtained ursine remains at Helsfell, including the basal portion of the cranium of a young Bear, and at least two large bones. Professor Dawkins has referred these relics to *Ursus priscus*...". It is possible that Mr Beecham kept the bear material, as they were not listed amongst the material sold to Kendal Museum; alternatively, it is possible that they were misidentifications and bear was not present at the site.

The human remains are also of interest. Macpherson does not mention human remains in his report, but he was writing on the vertebrate fauna of the Lakeland, and may not have included humans in with the other animals. He did note the presence of a bone point, but this is not reported in any other source and was never figured, so it cannot be verified. There is a definite human skeleton in the World Museum Liverpool collection, but the note 'human bones excepted' in the 1935 Kendal catalogue makes this, like the other Liverpool material, of doubtful provenance. The only other specimen is a tooth root in the Burneside school collection that could possibly be human. It would seem odd that if human bones and an artefact had been present in the cave, that a paper on the cave was not formally published, especially as we know that Watson presented a paper to the CWAAS. British archaeology at the time was more interested in classical rather than prehistoric archaeology (van Riper, 1993), which might explain the absence of a contemporary Helsfell publication. However the first paper published in the *Transactions of the CWAAS* was on prehistoric archaeology, indicating that the Society did have an interest in this subject.

How did the material get into the cave? Macpherson suggested that it was a wolf den, and that the wolves preyed upon pigs. Of the 50 specimens present at Coniston, only three show evidence of canid gnawing (C6/9, C6/12 and C6/24), which makes this explanation unlikely. While many of the smaller animals of rabbit to fox size could have made their own way into the cave, it is far too small a fissure for a sub-adult ox to have entered as a live animal. There are no cut marks on the bones, and while the cattle femur in Coniston is definitely fractured, it could be from rock fall as much as deliberate breakage. It seems

FIGURE 2. Specimens, actually cattle, incorrectly identified as deer in the collection of Ruskin Museum, Coniston.

FIGURE 3. The Burnside School material now in the Kendal Museum. Although this material is mounted on cards saying Helsfell cave it is unknown when they were mounted and if this provenance had just been assumed by whoever mounted them.

likely that the accumulation was natural, with some animals denning within the fissure and carrying bones back to it, while others may have washed in from the surface or the cave may even have been used to dispose of bones by local people.

Many of the animals in the Coniston collection are juvenile, as the limb bones are unfused or teeth are still erupting. However, adult cattle and dog/fox are represented by fused limb bones. In terms of body part representation, the remains are largely vertebrae (mainly of rabbit-to-fox sized mammals), juvenile limb bones and cranio-dental material (Appendix 1). Some bones are heavily eroded, and two of the 50 have a slightly mineralised appearance in comparison with the others. This concords with the World Museum Liverpool material which is also of a variety of preservation types from fresh-looking to mineralised (Wilkinson *et al.*, 2006).

Conclusions

What can be said of the Helsfell collection? Our reassessment of the surviving material suggests that the bear and human records were based on misidentifications of domestic taxa. Our historical researches also suggest that the provenance of the Pika in the Liverpool collection described by Fisher and Yalden (2004) must be considered suspect. The site provides a case study in the historical management of collections and also emphasises the importance of provenance for future research. More broadly it raises questions about the uncritical acceptance of provenance information associated with 19th century material and strongly cautions against taking contemporary species lists on trust in studies of the history of the British vertebrate fauna.

Acknowledgements

We are most grateful to the curators of the following museums and archives for access to their collections: Ruskin Museum Coniston, Kendal Museum, Kendal Record Office, World Museum Liverpool, Buxton Museum and Manchester Museum.

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APPENDIX 1: A catalogue of the surviving bone material in the Ruskin Museum, Coniston. All specimens are adult unless otherwise indicated.

Catalogue number	Bone	Side	General identification	Notes
C6/1	Lower M3	Left	Cattle	Partly mineralised
C6/1	Lower M3	Left	Cattle	
C6/1	Upper Pm4, refits into C6/20	Left	Cattle	
C6/1	Lower m3	Right	Sheep/goat	
C6/1	Upper m1/m2	Left	Sheep/goat	Just erupting – tip of one cusp worn
C6/2	Mandible	Left	Canid	
C6/3	Humerus	Right	Dog	Proximal epiphyseal line visible
C6/4	Lumbar vertebra		Dog	
C6/5	Cervical vertebra		Indet.	
C6/6	Mandible		Canid	
C6/7	Metatarsal	Left	Cattle	
C6/8	Metatarsal	Right	Cattle	
C6/9	Tibia, diaphysis only		Horse	Unfused, gnawed.
C6/10	Maxilla	Right	Pig	M2 erupting
C6/12	Ulna	Left	Dog	Gnawed
C6/12	Humerus	Right	Dog	
C6/13	Maxilla	Right	Dog	Tips of m1 just coming into wear
C6/14	Maxilla	Left	Sheep/goat	P2 just erupting
C6/14	Maxilla	Left	Sheep/goat	M3 just erupting
C6/14	Maxilla	Right	Sheep/goat	
C6/14	Mandible	Right	Sheep/goat	Edentulous
C6/14	Mandible	Left	Sheep/goat	P4 encrypted, m2 just in wear
C6/15	Femur	Right	Canid	
C6/16	Mandible	Left	Sheep/goat	Dm3 just in wear
C6/16	Mandible	Left	Sheep/goat	Dm3 unworn
C6/17	Tibia, diaphysis only		Cattle	Unfused
C6/18	Molar, upper		Horse	
C6/19	Mandible	Left	Cattle	
C6/20	Maxilla	Right	Cattle	M1 just in wear, m2 erupting, m3 crypt visible (tooth missing)
C6/21	Navicular cuboid		Deer/cattle	
C6/22	Femur, distal		Cattle	Unfused
C6/23	Rib	Right	Canid	Partly mineralised
C6/24	Vertebra, cervical fragment		Large quadruped	Gnawed

Continued on next page

APPENDIX 1 *continued*

Catalogue number	Bone	Side	General identification	Notes
C6/25	Vertebra frag		Large quadruped	
C6/26	Axis		Dog	
C6/26	Axis		Small carnivore	
C6/26	Atlas		Medium mammal	
C6/26	Lumbar vertebra		Smaller mammal (rabbit-fox size)	
C6/26	Cervical vertebra		Smaller mammal (rabbit-fox size)	
C6/26	Cervical vertebra		Smaller mammal (rabbit-fox size)	
C6/26	Cervical vertebra		Smaller mammal (rabbit-fox size)	
C6/26	Thoracic vertebra		Smaller mammal (rabbit-fox size)	
C6/26	Thoracic vertebra		Smaller mammal (rabbit-fox size)	
C6/26	Thoracic vertebra		Smaller mammal (rabbit-fox size)	
C6/26	Thoracic vertebra		Smaller mammal (rabbit-fox size)	
C6/26	Thoracic vertebra		Smaller mammal (rabbit-fox size)	
C6/26	Thoracic vertebra		Smaller mammal (rabbit-fox size)	
C6/26	Thoracic vertebra		Medium mammal (dog/sheep sized)	Juvenile (unfused)
No number	Navicular cuboid		Deer/cattle	
No number	Maxilla fragment		Indet.	

BOOK REVIEWS

The Humboldt Current by **Aaron Sachs.** Pp. xii + 496pp. Oxford University Press, 2007, £17.99 hardback.

The Humboldt Current, as every schoolchild once used to know, is the cold, northward-flowing ocean current off the west coast of South America. The name commemorates the life and contribution of the German explorer Alexander von Humboldt, who has claims to the title of the Founder of Modern Geography. He explored a great part of South America, later writing his *Personal Narrative of a Journey to the Equinoctial Regions of a New Continent, 1799-1804*. It was this work, read while he was at Cambridge, that gave Charles Darwin his desire to travel and make his own contribution to science. Humboldt later wrote *Cosmos*, a comprehensive, unifying survey of the earth and the universe.

In 1804, at the end of his explorations, Humboldt spent six weeks in the United States, which he saw as a beacon of liberty, having witnessed the revolutionary Terror in France and some of the excesses of the Spanish empire. He spent much time with Thomas Jefferson, who was President not only of the nation, but also of the American Philosophical

Society, the young nation's leading scientific organisation. Humboldt regarded Jefferson as a 'friend of science' who had himself contributed significantly to scientific endeavour.

Aaron Sachs, a historian at Cornell University, has discussed the legacy of those six weeks and the impact of Humboldt's subsequent publications on the development of scientific, geographical and philosophical thought in the United States in an important, beautifully written and extremely well-produced book. In a very real way Humboldt could be considered the first ecologist and one of the first environmentalists. He saw a 'chain of connection' between living beings and emphasised the relationships between climate, vegetation, soils and landscapes, thus envisaging a 'unity of nature'. He was no mean geologist, and a competent botanist, but was also imbued with the ideas of the Romantic movement; having seen slavery in South America, Cuba and the USA he was a passionate abolitionist. He influenced the writers Walt Whitman, Henry Thoreau and Edgar Alan Poe, as well as the explorer-scientists John Muir (who was originally from Scotland), George Wallace Melville, Clarence King and J. N. Reynolds.

Aaron Sachs reviews Humboldt's sojourn in America (mainly Washington and Philadelphia) in May, June and early July 1804, and then outlines the 'chains of connection' or 'currents' of the influence of Humboldt's thought in nineteenth century America.

The remainder of the book is divided into four parts. *East*, subtitled 'Humboldt and the influence of Europe', discusses the 'radical romanticism' of the *Personal Narrative* and the unifying ideas of *Cosmos*. *South* discusses J. N. Reynolds and the 'More Comprehensive Promise' of the Antarctic. *West* looks at Clarence King's experience of the western frontier, and early mountaineering in the Sierra Nevada. *North* examines the United States' ventures into the Arctic, spearheaded by Muir and Melville. A final chapter discusses the notion that Humboldt was the starting point for the development of American environmentalism, seeing George Perkins Marsh, C. Hart Merriam and Edward Curtis as important links between Humboldtian thought and modern ecology.

The author provides nearly 70 pages of notes, a chronology, an extensive bibliography and index. There are a number of black-and-white images – mainly landscapes and portraits, diagrams and a few maps. The attractive colour dust-jacket shows a portrait of Humboldt examining a plant specimen.

Humboldt was a towering figure, although now ill-remembered. His influence on Darwin and many other 19th century scientists and thinkers was enormous. In a number of ways he influenced the direction of modern science. Aaron Sachs has done justice to Humboldt's life, work and legacy in this scholarly book.

PHA

The Great Naturalists edited by **Robert Huxley**. Pp. 304, incl. numerous coloured & b/w plates. Thames & Hudson, in association with The Natural History Museum. 2007. £24.95 hardback.

This beautifully produced work is a fitting tribute to some remarkable pioneer naturalists, succinctly but expertly portrayed in words and illustrations (the majority selected from the unique archives and collections of The Natural History Museum, London). In all, 39 European and American naturalists are individually covered by leading scholars under four headings: The Ancients (Aristotle, Theophrastus, Dioscorides, Pliny the Elder), The Renaissance (Fuchs, Aldrovandi, Cesalpino, Belon, Gessner), The Enlightenment (Steno, Ray, Hooke, van Leeuwenhoek, Sloane, Merian, Catesby, Linnaeus, Buffon, Steller, Adanson, Darwin, Bartram, Banks, Fabricus, Hutton, Lamarck, de Jussieu, Cuvier), and The 19th Century (William Smith, von Humboldt, Audubon, Buckland, Lyell, Anning, Owen, Agassiz, Darwin, Wallace, Gray). Although readers of *The Naturalist* will be attracted primarily to British naturalists or those who have contributed significantly to their own specialist study area, this volume provides a broader platform on which to study the history of natural history, and would make a perfect (and inexpensive!) gift not only for devotees of the subject, but also for a wider readership.

MRDS

BOTANICAL REPORT FOR 2008: FLOWERING PLANTS AND FERNS

Compiled by
P. P. ABBOTT

Several rare and unusual plants have been found throughout the county this year. During the YNU visit to North Cave Wetlands, a mint, introduced into one of the dragonfly ponds and naturalised, and which none of us recognised, was eventually identified by P.P.Abbott and verified by E.J.Clement as *Mentha cervina*, a native of south-west Europe and new to Britain. Perhaps even more exciting was the fact that two flowers have appeared in Yorkshire on plants which have been introduced as part of the Cypripedium project. The triple hybrid willow, *Salix myrsinifolia* x *phylicifolia* x *repens*, found by the R.Tees is new to England and only the third record in Britain. Other interesting finds are listed below.

NORTH-EAST YORKSHIRE (VC62) (G. Smith)

All records GS unless otherwise stated
Ophioglossum vulgatum L. Worm Sike, trackside SE8796
Polystichum setiferum (Forssk.) T. Moore ex Woyn. Forge Valley, river bank SE9887
Helleboris viridis L. Ashberry Woods SE5784
Actaea spicata L. Gilling, woodland SE6176
Ranunculus penicillatus (Dumort) ssp. *pseudofluitans* (Syme) S.D. Webster Forge Valley SE9887
Ranunculus sardous Crantz Catter Bridge, field SE7285; one plant
Stellaria neglecta Weihe Hovingham, waterside SE6574
Spergula arvensis L. Whitwell, set-aside field SE7265
Silene noctiflora L. Welburn, fallow field behind church SE7267
**Frankenia laevis* L. Howkeld, A170 lay-by SE6858, BT conf. NS
Erysimum cheiranthoides L. Gilling, set-aside field SE6077
Sinapis alba L. Appleton, field SE7187
Andromeda polifolia L. May Moss, peat bog SE8795
Vaccinium oxycoccos L. May Moss, peat bog SE8795
Primula vulgaris Huds. Gilling, Beckside SE6176
Trientalis europaea L. Hole of Horcum, steep bank SE8493
Rubus saxatilis L. Hawnby, woodland SE5289, YNU
Prunus padus L. Hawnby, grassy bank SE5389, YNU
Anthyllis vulneraria L. Gilling, woodland ride SE5975
Genista anglica L. Hawnby Hill, moorland SE5391
Daphne laureola L. Ashberry Woods SE5784
Cornus suecica L. Hole of Horcum, steep bank SE8493
Geranium pusillum L. Gilling, old railway SE6277
Pimpinella saxifraga L. Hawnby, grassy bank SE5389, YNU
Gentianella amarella (L.) Börner Gilling, clearing SE6075
Calystegia pulchra Brummitt & Heywood Hawnby village SE5489, YNU
Myosotis stolonifera (DC) J.Gay ex Leresche & Levier Hole of Horcum, marsh SE8493
Lamium hybridum Vill. Whitwell, field, near monument SE7166
Plantago coronopus L. Gilling, woodland SE5876
Ligustrum vulgare L. Hawnby, grassy bank SE5389, YNU
Verbascum thapsus L. Hawnby, grassy bank near Noddle End SE5288, YNU
Veronica scutellata L. Hole of Horcum, marsh SE8493
Lathraea squamaria L. Sinnington, woodland SE7487
Campanula latifolia L. Whitwell, road verge SE7267
Sherardia arvensis L. Welburn, fallow field SE7267

Scabiosa columbaria L. Hawnby, grassy bank SE5389, YNU
Crepis biennis L. Slingsby, road verge SE7469
Crepis vesicaria L. Whitwell, car park SE7166
Senecio aquaticus Hill Hawnby, grassy bank SE5389, YNU
Senecio viscosus L. Whitwell, A64 verge SE7266
Convallaria majalis L. Sinnington, woodland SE7487
Paris quadrifolia L. Hawnby, woodland SE5289, YNU
Epipactis helleborine (L.) Crantz Whitwell, woodland edge SE7167; 10 plants, 1 leucistic
Anacamptis pyramidalis (L.) Rich. Slingsby, road verge SE7074
Orchis mascula (L.) L. Sinnington, woodland SE7487
Orchis morio L. Hole of Horcum, field SE8493

SOUTH-WEST YORKSHIRE (VC63) (D. R. Grant)
Nymphoides peltata Kuntze Santingley Grange, pond SE 3816, JG
Rubus nemoralis P.J.Müll. Old Royston, old railway SE3812, DRG; South Hiendley SE3912, DRG
Rubus rufescens Lefèvre & P.J.Müll. Silkstone Common, woodland SE2904, TS
Rubus warrenii Sudre Chesterfield Canal SK5381, YNU
Hieracium vagum Jord. Santingley Grange, old railway SE3816, DP
Hieracium grandidens Dahlst. Lindrickdale Quarry SK5482, DRG
Bromopsis inermis (Leyss.) Holub Horbury, by River Calder SE2917, DRG
Epipactis helleborine (L.) Crantz Old Royston, canal bank SE3613, DP
Dactylorhiza praetermissa (Druce) Soó Normanton by-pass, roadside SE3820, II
Chara vulgaris var. *longibractata* (Kütz) H. & J. Groves Brodsworth Country Park, ditch SE5207, TS

MID-WEST YORKSHIRE (VC64) (P. P. Abbott)
Selaginella selaginoides (L.) P.Beauv. Arncliffe SD9270, YFG
Equisetum sylvaticum L. Standridge SD7353, PCGG; Park House Farm SE2346, WNS
Ophioglossum vulgatum L. Settle, Lord's Pasture SD8164, CCG
Botrychium lunaria (L.) Sw. Kilnsey Moor SD9466, WNS
Trichomanes speciosum Willd. (gametophyte) Otley Chevin SE2244, BBr
Polypodium x *mantoniae* Rothm.& U. Schneid. (= *P. vulgare* x *P. interjectum*)
Kettlewell SD9672, BBr; Yew Cogar Scar SD9170, YFG; Attermire SD8464, BBr
Polypodium x *font-queri* Rothm. (= *P. vulgare* x *P. cambricum*) Janet's Foss Wood SD9163, BBr conf. KT
Polypodium x *shivasiae* Rothm. (= *P. interjectum* x *P. cambricum*) Yew Cogar Scar SD9170, YFG
Polystichum setiferum (Forssk.) T.Moore ex Woyn. Malham Cove, pavement SD8964 BBr; Menston, old rail line SE1744, BBr
**Polystichum* x *bicknellii* (H.Christ) Hahne (= *P. setiferum* x *P. aculeatum*) Malham Cove, pavement SD8964, BBR
Polystichum lonchitis (L.) Roth Attermire SD8263, BBr
**Dryopteris* x *complexa* Fraser-Jenk. (= *D. filix-mas x affinis*) Otley Chevin SE2144, BBr
Dryopteris submontana (Fraser-Jenk. & Jermy) Fraser-Jenk. Oxenber Wood SD7868, BBu; Arncliffe Clowder SD9169, WNS
**Dryopteris* x *deweveri* (J.T.Jansen) Wacht. (= *D. carthusiana* x *dilatata*) Askham Bog SE5748, BBr
Juniperus communis L. W of Clapdale, pot hole SD7470, BBu
Trollius europaeus L. Bolton Abbey SE0755, PCGG; Litton SD9172, CRA & PPA
Ceratocapnos claviculata (L.) Lidén Barden SE0456, WNS
Carpinus betulus L. Spofforth, Haggs Farm SE3351, PPA
**Atriplex portulacoides* L. Stonehouse SE1558, WNS
Stellaria nemorum L. Fewston, by reservoir SE1654, ES

Silene x *hampeana* Meusel & K.Werner (= *S. latifolia* x *dioica*) Thruscross, below reservoir SE1656, WNS
Persicaria vivipara (L.) Ronse Decr. Cray Gill SD9378, KJW
Rumex longifolius DC. Stonehouse SE1458, WNS
Rumex x *hybridus* Kindb. (= *R. longifolius* x *obtusifolius*) Humberstone Bank SE1360, BAT & MW
Rumex palustris Sm. Rodley Reserve SE2336, BBG
Drosera rotundifolia L. Dunsop Bridge SD6749, PCGG
Viola rupestris F.W.Schmidt Ingleborough, below Sulber SD7872, PPA, BBu & MW
Viola x *burnatii* Gremli (= *V. rupestris* x *riviniana*) Ingleborough, below Sulber SD7872, PPA, BBu & MW
Populus tremula L. Spofforth SE3351, PPA; Deepdale SD8879, WNS
Populus nigra ssp. *betulifolia* (Pursh) Dippel South Milford SE5031, JB
Salix pentandra L. South Milford, Oak Tree Farm SE5031, PPA & JB
Salix x *rubra* Huds. (= *S. purpurea* x *viminalis*) Stocks Reservoir SD7356, MW
Salix x *multinervis* Döll (*S. cinerea* x *aurita*) Stocks Reservoir SD7356, MW
Lepidium ruderale L. Leeds SE3034, JM
Coronopus didymus (L.) Sm. Addingham SE0848, WNS
Diplotaxis muralis (L.) DC. Otley, A660 pavement edge SE2044, BBr
Sedum villosum L. Selside, Alum Pot Lane SD7875, KJW
Saxifraga granulata L. Beamsley, by Kex Beck SE0953, WNS; Greenhow, Cock Hill lead mine SE1164, BBG
Chrysosplenium alternifolium L. Beamsley, by Kex Beck SE0953, WNS
Filipendula vulgaris Moench Settle, Lord's Pasture SD8164, CCG; Lawkland Moss SD7666, ES
Rubus chamaemorus L. Old Cote Head SD9274, WNS
Rubus incurvatiformis Edees Gisburn Forest SD7558, DRG
Rubus mucronulatus Boreau Timble Ings SE1553, DRG
Rubus lindebergii P.J.Müll. Little Stainforth, by railway bridge SD8167, DRG
Potentilla crantzii (Crantz) Beck ex Fritsch Ribblehead, larch wood SD7678, BBu
Potentilla tabernaemontani Asch. Whitewell SD6546, PCGG
Potentilla x *suberecta* Zimmeter Stocks, by reservoir SD7356, MW
Lathyrus linifolius (Reichard) Bässler Slaidburn SD7056, PCGG
Ononis repens L. Otley, riverside SE1845, BBr
Genista anglica L. Langcliffe Quarry SD8266, ES
Epilobium x *dacicum* Borbás (= *E. parviflorum* x *obscurum*) Menwith Hill SE1856, BAT & MW
Epilobium roseum Schreb. Ingleborough SD7477, MW
Viscum album L. Barkston Ash SE4936, JD
Euonymus europaeus L. W of Clapdale SD7471, BBu
Silaum silaus (L.) Schinz & Thell. Settle, Lord's Pasture SD8064, CCG
Gentianella campestris (L.) Börner Malham, E of tarn SD8966, PPA & KW
Solanum nigrum L. Giggleswick SD8163, MC
Polemonium caeruleum L. Grass Wood SD9965, DRG
Echium vulgare L. Otley, Russel Farm SE2044, WNS; Ellington Banks SE2672, YNU
Scutellaria minor Huds. Keasden Moor SD7266, BBu
Galium boreale L. Malham SD8966, PPA & KW
Arctium lappa L. Thorp Arch, grounds of British Library SE4446, BBG
Serratula tinctoria L. Settle, Lord's Pasture SD8064, CCG
Picris hieracioides L. Burton Leonard, lime quarry SE3262, KJW
Taraxacum unguilobum Dahlst. Ingleborough SD7872, PPA, BBu & MW det. BBu
Crepis mollis (Jacq.) Asch. Starbotton SD9475 & 9574, KJW
**Hieracium amnicola* P.D.Sell Malham, Lang Scar SD8865, BBG det. BBu
Hieracium oistophyllum Pugsley Buckhaw Brow SD7866, DRG

**Hieracium boreoanglicum* P.D.Sell Giggleswick Quarry SD8064, DRG
**Hieracium subcyaneum* (W.R.Linton) Pugsley Newby Cote, Grey Scar SD7371, DRG
Antennaria dioica (L.) Gaertn. Below Twistleton Scar SD6975, BBu
Inula conyzae (Griess.) Meikle Cave Hole Wood SD7866, DRG; Stutton SE4740, PT
Potamogeton pusillus L. Eavestone Lake SE2268, DJT det. CDP
Potamogeton obtusifolius Mert. & W.D.J.Koch Eavestone Lake SE2268, DJT conf. CDP
Zannichellia palustris L. Ellington Banks SE2773, YNU
Juncus alpinoarticulatus Chaix Ingleborough SE7872, PPA, BBV & MW
**Juncus* x *kern-reichgeltii* Jansen & Wacht. ex Reichg. (= *J. effusus* x *conglomeratus*) Ingleborough SD7475, MW; Baildon Moor SE1339, BAT & MW
Blysmus compressus (L.) Panz. ex Link Bolton Abbey SE0754, KJW
Carex x *fulva* Gooden. (= *C. hostiana* x *viridula*) Attermire SD8463, YNU; Darnbrook SD9070, KJW
Carex ericetorum Pollich Burton Leonard, lime quarry SE3262, KJW
Poa humilis Ehrh. ex Hoffm. Greenhow, roadside SE1163, BBG det. MW
Catapodium rigidum (l.) C.E.Hubb. Otley Wetlands Reserve SE1945, WNS
Melica nutans L. Barden SE0456, WNS
Paris quadrifolia L. Scarthingwell, Patefield Wood SE4938, JD
**Allium schoenoprasum* L. Greenhow Hill Road SE1558 & 1658, WNS
Allium oleraceum L. Selside SD7874, HS
Allium scorodoprasum L. Ledsham, Newfield Lane SE4528, PPA
Epipactis phyllanthes G.E.Sm. Ellington Banks SE2873, YNU
Anacamptis pyramidalis (L.) Rich. Ribblehead Quarry SD7678, CCG
Dactylorhiza x *venusta* (T. & T. A. Stephenson) Soó Ribblehead Quarry SD7678, CCG

NORTH-WEST YORKSHIRE (VC65) (K. J. Walker)

Persicaria vivipara (L.) Ronse Decr. Holwick NY9092, MEB *et al.*
**Salix myrsinifolia* x *phylicifolia* x *repens* above Middleton-in-Teesdale, river bank NY92, DJT conf. RDM
Alchemilla monticola Opiz Romaldkirk, Hayberries NY9922, MEB *et al.*
Alchemilla subcrenata Buser Holwick NY9071 & 9072, MEB *et al.*
Alchemilla acutiloba Opiz NW of Wynch Bridge NY9028, MEB *et al.*
Alchemilla glomerulans Buser Ettersgill, Holwick Bridge NY9824, MEB *et al.*; Holwick NY9027, MEB *et al.*
Alchemilla wichurae (Buser) Stefánson Ettersgill, Holwick Bridge NY9824, MEB *et al.*; Holwick NY9027, MEB *et al.*
Crepis mollis (Jacq.) Asch. Worton Scar SD9689, KJW; E of Wynch Bridge NY9027, LR & KJW; Holwick NY9027, LR & KJW
Eriophorum latifolium Hoppe above Locker Tarn SE0091, CEP & KJW
Carex x *fulva* Gooden. (= C. *hostiana* x *viridula*) Locker Tarn SE0018, CEP & KJW
Carex x *decolorans* Wimm. (= *C. nigra* x *bigelowii*) Great Shunner Fell SD8497, RWMC & LR
Pseudorchis albida (L.) Á. Löve & D. Löve Holwick NY9027, JO; Marsett Rigg SD8986, KJW

ALIEN PLANTS (G. T. D.Wilmore)

(All VC 63 records below were found in the course of recording for the South Yorkshire Plant Atlas Project)
**Papaver atlanticum* (Ball) Coss. Sheffield, near Neill Road SK3385, KB
**Betula papyrifera* Marshall Farnhill, scrubby heathland SE0046, BKB & MC
**Lychnis flos-jovis* (L.) Desr. Ilkley, riverbank SE1148, NV
Gypsophila elegans M.Bieb. Sheffield Manor, waste ground SK3885, KB
**Rheum palmatum* L. Wigglesworth, roadside SD8157, ES
Hypericum x *inodorum* Mill. (= *H. androsaemum* x *hircinum*) Sheffield Manor SK3885,

KB; near Langcliffe, bank of mill pond SD8165, MC conf. NKBR
Sisymbrium irio L. Broomhill SE4102, MW
Tolmiea menziesii (Pursh) Torr. & A.Gray Thurgoland SE2800, TS; Cray Gill SD9378, KJW
Aruncus dioicus (Walter) Fernald Wigglesworth, roadside SD8157, PPA & MC
**Crataegus* x *lavallei* Hérincq. Farnhill, scrubby heathland SE0046, MC conf. BKB
Vicia villosa Roth Sheffield Manor, waste ground SK3885, KB
**Clarkia amoena* (Lehm.) A.Nelson & J.F.Macbr. Ilkley, riverbank SE1148, NV
**Euonymus fortunei* (Turcz.) Hand.-Mazz. Blubberhouses SE1658, WNS
Geranium phaeum L. Slaidburn SD7353, PCGG
Nicandra physalodes (L.) Gaertn. Sheffield, St Mary's Road SK3586, KB
**Petunia* x *hybrida* (Hook.) Vilm. (= *P. axillaris* x *integrifolia*) Otley, town centre SE2045, BBr
Phacelia tanacetifolia Benth. Sheffield Manor, waste ground SK3885, KB
Amsinckia micrantha Suksd. Thorp Arch trading estate SE4446, BBG
Sutera cordata Otley, town centre SE2045, BBr
Asarina procumbens Mill. Staincross, disused quarry SE3210, GB
Asarina procumbens Mill. Ilkley SE1046, WNS
**Linaria maroccana* Hook.f. Sheffield Manor SK3885, KB; Woodhouse, Leeds, pavement weed SE2933, GT
Erinus alpinus L. Malham, Watlowes, limestone scar SD8964, BBG
**Hebe* x *fransiscana* (Eastw.) Souster (= *H.elliptica* x *speciosa*) Otley Chevin, Yorkgate Quarry SE1944, BBr
Lonicera tatarica L. Otley Chevin SE2244, BBr
Dipsacus laciniatus L. Flaxby, A59 verge SE4057, BAT & MW
Onopordium acanthium L. Arksey, road verge SE5807, AK
Silybum marianum (L.) Gaertn. Scarcroft SE3440, JS
Tragopogon porrifolius L. Swillington, St. Aidan's SE3927, JM
Ambrosia artemisiifolia L. Little Preston SE3830, JM
Briza maxima L. Sheffield, near Neill Road SK3385, KB
Polypogon monspeliensis (L.) Desf. Sheffield, Parson Cross SK3492, KB
**Puschkinia scilloides* Adams Dale Head SD8471, BBG conf. EJC
**Sisyrinchium californicum* (Ker Gawl) W.T.Aiton Ilkley, riverbank SE1148, NV

Nomenclature is according to *Vice-county Census Catalogue of Vascular Plants of Great Britain* edited by C.A.Stace, R.G.Ellis, D.H.Kent & D.J.McCosh. * Denotes a new vice-county record. The Recorders thank all those who have contributed records or verified identifications as follows: C.R.Abbott (CRA), P.P.Abbott (PPA), J.Bradley (JB), M.E.Bradshaw (MEB), G.Bristowe (GB), B.Brown (BBr), B.Burrow (BBu), B.K.Byrne (BKB), M.Canaway (MC), E.J.Clement (EJC), R.W.M.Corner (RWMC), Craven Conservation Group (CCG), J.Dobson (JD), D.R.Grant (DRG), J.Greaves (JG), P.C.G.Green (PCGG), I.Instone (II), A.Kafel (AK), J.Martin (JM), R.D.Meikle (RDM), J.O'Reilly (JO), C.E.Pinches (CEP), C.D.Preston (CDP), D.Proctor (DP), L.Robinson (LR), N.K.B.Robson (NKBR), T.Schofield (TS), J. Scott (JS), H.Sergeant (HS), E.Shorrock (ES), G. Smith (GS), N.Sykes (NS), P.Tannett (PT), D.J.Tennant (DJT), B.Thompson (BT), B.A.Tregale (BAT), K.Trewren (KT), G. Twigge (GT), N.Vernon (NV), K.J.Walker (KJW), Wharfedale Naturalists' Society (WNS), M.Wilcox (MW), G.T.D.Wilmore (GTDW), K.Woodward (KW), Yorkshire Fern Group (YFG) and Yorkshire Naturalists' Union (YNU).

YORKSHIRE NATURALISTS' UNION EXCURSIONS IN 2007

Compiled by
ALBERT HENDERSON and ADRIAN NORRIS

NETHERGILL (VC64) 19 May 2007 (SD/862822)

INTRODUCTION (P. P. Abbott)

On a fiercely blustery day with frequent heavy showers, 14 members representing 16 affiliated societies met at Nethergill Farm, at an altitude of 380 m, where our hosts, Fiona and Chris Clark, greeted us with the option of hot drinks. Accompanied by them, we headed first for Oughtershaw Beck and across into the pine plantation on a springy raised bog – a unique and intriguing experience. In the afternoon we moved onto the S-facing slope and followed a stream up to a waterfall and surrounding rocks, then descended via other species-rich flushed areas.

Few insects were about on such a wild day but the Green-veined White Butterfly ventured out and a beetle *Meloë proscarabaeus* was found under a rock. The black-headed woodlouse *Porcellio spinicornis* was common on walls, and a buzzard's nest was located in the woodland.

The meeting was held in a barn with swallows flying to and from their nest. Biscuits and boiling water for teas was laid on by Fiona and thanks were given to the Clarks for their hospitality. They had accompanied us all day and our lists will be sent to them to help with their application for a Higher Level Stewardship grant.

CONCHOLOGY (A. Norris)

Three members of the section and two guests from the Conchological Society of Great Britain attended the meeting and the wet, windy weather did not dampen our enthusiasm one bit. 32 species of land and freshwater mollusca were recorded within the precincts of the farm, 10 slugs and 22 snails. The wet weather brought the slugs out in very large quantities, but most intriguing perhaps was the occurrence of *Limacus maculatus*. This slug has spread rapidly across Yorkshire since it was first recorded at a YNU meeting in April 1992 and is now found in four of our vice-counties; Nethergill is only just south of VC65, the only remaining VC from which it has not been recorded. Some have speculated that its spread is mainly due to gardeners transferring plants from one location to another. It is interesting to note that the owners of the farm stated that they had brought plants from their previous garden with them when they moved in a few years ago.

Although situated on the junction of the limestone and the grits, with a large number of flushes, it was noticeable that none of the larger species of land snail occurred within the farm. The flushes did, however, produce a number of interesting finds including *Vertigo substriata*, *V. pygmaea* and *Columella edentula*.

LEPIDOPTERA (Terry Crawford)

The poor weather made it difficult to record lepidoptera but two, possibly three, Green-veined White, *Pieris napi* were seen in flight; two adult moths, the Grey Pine Carpet *Thera obeliscata* and a White Ermine *Spilosoma lubricipeda* were seen, the latter sitting on vegetation. A larva found by a gate was later identified as a Barred Red *Hylaea fasciaria*, and the frequent larvae under the top stones on the drystone walls proved to be of the Muslin Footman *Nudaria mundana*.

ENTOMOLOGY (A. Grayson)

Strong unrelenting cold breezes combined with frequent showers were not conducive to entomological recording. Almost all the species recorded were taken by sweeping tussocks. The Diptera included *Bibio marci*, *Platypalpus longicornis*, *Rhamphomyia crassirostris*, *R. geniculata*, *R. stigmosa*, *Platycheirus clypeatus* sensu stricto, and the large hoverfly *Sericomyia silentis*.

PLANT GALLS (Tom Higginbottom)

Only five galls were recorded during the meeting. The ascomycete *Taphrina betulina* was common in the birch woodland. Wherever rowan occurred, the mite *Eriophyes sorbi* was discovered on the leaves. Another mite gall *Aceria pseudoplatani* was common on the leaves of sycamore. The mite gall *Phyllocoptes goniothorax* which causes the distinctive leaf roll on the edge of hawthorn leaves was also present. Each colony of stinging nettle was the host for various interesting distortions of the stem and leaves, in hues of orange and red, of the rust gall *Puccinia urticata*

FLOWERING PLANTS (P. P. Abbott)

Although the memorable pine plantation over raised bog was generally species-poor, dominated by *Sphagnum* and *Vaccinium myrtillus*, we were pleased to find a large patch of *Vaccinium oxycoccos*, creeping amongst the *Sphagnum*. Along the beck we saw *Cochlearia pyrenaica, Primula vulgaris* and *P. farinosa*. *Valeriana dioica* was particularly attractive with deep pink buds and paler open flowers.

The S-facing fields rise up to 460 m towards the watershed with Wensleydale and the Yoredale series of rocks support an interesting combination of calcicole and calcifuge plants. In the flushed areas, as well as *Primula farinosa* and *Pinguicula vulgaris* there were ten species of sedge, including *Carex dioica*. In drier areas there were four species of Lady's-mantle, including *Alchemilla glaucescens* which, though frequent in the Yorkshire Dales, is nationally rare. The rocks by the waterfall held *Hypericum pulchrum* and *Solidago virgaurea* which would flower later in the year.

BRYOLOGY (Jean Kendrew)

Initially, in the morning, members visited the pine wood (SD/857821) and recorded the following species: *Breutelia chrysocoma, Hylocomium splendens, Hypnum cupressiforme, Orthotrichum tenellum, Plagiothecium undulatum, Polytrichum commune, P. juniperinum, Rhytidiadelphus loreus, Sphagnum capillifolium, S. cuspidatum, S. fimbriatum, S. palustre, S. papillosum, S. subnitens* and *Tetraphis pellucida*. The wood was spectacular for its moss coverage, mainly *Rhytidiadelphus loreus* and also for *Sphagna*. There were small pools in the area and the substrate gave acid conditions.

After lunch the field containing a waterfall (SD/863823) was explored and *Leucobryum glaucum, Fontinalis antipyretica* and *Tortella tortuosa* were noted. The field had sandstone and limestone exposures, a stream and in places alkaline flushes.

Judith Allinson, Donald Grant and Margaret Hartley contributed to the list.

JERVAULX (VC65) 16 June 2007 (NGR Centrum SE176857)

INTRODUCTION (Deborah Millward)

17 members from 14 societies attended the meeting. Torrential rain had fallen on the previous day and more was threatened, but members were blessed with dry conditions until 3.00pm when most beat a retreat to the tea room for delicious homemade cake.

Most, if not all, members spent time in the priory precinct where the abundance of species was particularly noticeable. Many ancient historic buildings are kept immaculate to the point of sterility but Jervaulx Abbey has riots of plants on the walls with tall trees around the perimeter. These conditions made for particularly high numbers of invertebrates, especially Diptera, and the conchological team were rewarded with live specimens of a much sought-after tiny snail. The abbey precinct yielded 15 plant galls, 30 mosses and 50 lichens.

The botanists headed firstly to the fen, then recorded fairly thoroughly around the more northerly fishing lake, finishing at the abbey where a mere seven species were added to the already comprehensive list of almost 200.

The birders included the River Ure in their searches and clocked up 48 species, down slightly on the 1969 excursion record of 55, but the latter had covered a wider area. The Union had held its 139th meeting at Jervaulx in 1898 and a copy of the circular for that

meeting referred to the site as virgin territory – this is certainly no longer the case. One of the very few species known to occur here in 1898 was the native white-clawed crayfish; ironically it was the alien American signal crayfish which was recorded on this occasion.

Our host, Mr Ian Burdon, was there to greet us on arrival and looks forward to receiving copies of all the reports. The Divisional Secretary has written with our thanks and will ensure reports are forwarded to him.

CONCHOLOGY (A. Norris)

38 species were recorded on the day, bringing the total for the immediate area surrounding Jervaulx Abbey to 61, of which 29 have been recorded from within the precinct of the abbey itself. Of the 61 species recorded, only three have not been found post-1969, and all of these are freshwater species recorded in the past from the River Ure. Six species were recorded for the first time: *Lehmannia marginata* from the walls of the Abbey, *Arion flagellus* and *Euconulus* cf *alderi* from the area of the fen, and *Potamopyrgus antipodarum* and *Radix balthica* from the fish-pond. By far the commonest species found on the day was *Helicigona lapicida*, abundant on the walls of the abbey ruins after the recent rains.

Four members of the Molluscan Section turned out in the hope of finding a rare snail recorded by Dr L. Lloyd Evans at the meeting on 5 July 1969. He recorded a single dead shell of *Vertigo pusilla* on one of the abbey walls, but frequent visits since that date have failed to locate any further specimens. The fear was that the species had become extinct at the site. However, we did locate two young live specimens on this occasion on one of the old rubble walls at SE/17139.85771, under stones and amongst moss. We are grateful to J.M. Blackburn who identified the two main mosses as *Hypnum cupressiforme* var. *lacunosum* and *Dicranum scoparium*. The rediscovery of this minute snail alive brings the total, for which live material of this species has been found, to 7 known sites within Yorkshire over the past 20 years.

ENTOMOLOGY (A. Grayson)

The day was punctuated by showers; hence, most insects were to be found in sheltered situations, such as amongst the abundant vegetation on the walls and grounds of the ruined abbey, and amongst the branches of trees in Jervaulx Park. With the exception of Diptera, only a meagre list of insects was produced. The only Lepidoptera seen were *Vanessa atalanta*, *Pararge aegeria*, *Petrophora chlorosata*, a larva of *Cucullia verbasci* on *Verbascum*, and *Tyria jacobaeae*, which was seen in Jervaulx Fen by Adrian Norris. The only Odonata were the damselflies *Calopteryx splendens* and *Enallagma cyathigerum*; both sexes of the latter species being abundant amongst vegetation surrounding a large pond in Jervaulx Park (SE/179855), around which the horsefly *Haematopota crassicornis* also occurred on fence-rails. Few Hymenoptera were active, apart from the bumblebees *Bombus lapidarius*, *B. lucorum*, *B. pascuorum* and *B. pratorum*. Lush vegetation on and around the walls of the abbey contained an abundance of sheltering Diptera, including *Chloromyia formosa*, *Platypalpus pallidiventris*, *Empis albinervis*, *E. nuntia*, *Hilara litorea*, *Dolichopus ungulatus*, *Poecilobothrus nobilitatus*, *Sciapus platypterus*, *Platycheirus albimanus*, *Episyrphus balteatus* and *Volucella pellucens*. The dipterous highlight of the excursion was the distinctly uncommon hoverfly *Eristalis abusivus*, of which a male was found on flower-heads of *Cirsium* growing on a roadside leading to Jervaulx Fen (SE/184856). Here too, on *Cirsium*, were *Empis tessellata*, *Eristalis tenax and Syritta pipiens*.

PLANT GALLS (Tom Higginbottom)

20 galls were discovered in the precinct of the ruined abbey. Many of the sloes on blackthorn had been enlarged by the fungal gall *Taphrina pruni*. On some of the leaves of wych elm the stalked club-shaped gall caused by aphids of *Tetraneura ulmi* were noted. Four galls were recorded on ash: the mite gall *Aceria fraxinivorus* had distorted the flowers; the edge of many leaves had been rolled by the psyllid *Psyllopsis fraxini*; the gall midge *Dasineura fraxini* had enlarged the main vein of some leaves; and the more

uncommon gall midge *Dasineura acrophila* had folded the occasional leaf into a pod shape. However, the most interesting discovery of the day took place by the fish ponds, where the botanists found quite a few specimens of the gall wasp *Lispothenes glechomae* which causes hairy globular swellings on ground ivy. This is quite an uncommon gall in Yorkshire. A total of 32 galls were recorded.

MYCOLOGY (Tom Higginbottom)

Down by the fen Adrian Norris drew my attention to a rust on caper spurge *Euphorbia lathyris*. The specimen was sent to Dr Brian Spooner at the Royal Botanical Gardens at Kew. He identified the rust as *Melampsora euphorbiae*. He added the following comment, "it seems to have been first reported from Wales in 1996, found then in Shropshire in 1998, and in Middlesex and Surrey in 1999. Still spreading a bit it seems, but it may well be new to Yorkshire on this host. Both uredia and telia are present on this specimen. I have kept it for Kew Herbarium, accessed as K(M)147952".

FLOWERING PLANTS (Deborah Millward)

Five botanists first headed to Jervaulx Fen, an acre of dominant *Filipendula ulmaria* with frequent *Epilobium hirsutum* and *Carex acutiformis*, occasional *Angelica sylvestris* and *Valeriana officinalis,* and a small stand of *Salix cinerea*. New for the site was scattered *Allium scorodoprasum*. In the area of tipping on the southern edge of the fen *Malva sylvestris, Symphytum tuberosum* and an alien garden *Geranium* were recorded with abundant *Urtica dioica* and *Euphorbia lathyris*. Members were concerned that the latter, a vigorous garden plant, might invade the fen, and expressed regret that part of this fine site was being lost to agricultural and garden waste.

After the shoulder high *Filipendula* the area around the fishing lake (SE/180856) was considerably easier to work. Here a more comprehensive list was researched as the area was thought to be unrecorded. For such a small site, much of it open water, it was remarkably rewarding with 86 species recorded. Tall grassland leading down to the wetland was species-rich with *Centaurea nigra*, *Conopodium majus, Festuca pratensis, Lathyrus pratensis, Primula veris* and *Stachys officinalis*. The wetland supported a fine stand of *Thalictrum flavum* with *Filipendula ulmaria* (again), *Angelica sylvestris, Galium palustre* and *Mentha aquatica*. At the water's edge *Typha latifolia, Carex vesicaria, Myosotis scorpioides, Veronica catenata* and *Persicaria amphibia* grew in abundance, the latter well out into open water. A brilliantly coloured, apparently aquatic, plant morphed firstly into a dragonfly and finally into a fishing lure!

On the hillock above, calcicoles included *Koeleria macrantha, Sanguisorba minor, Carex caryophyllea* and the man-high *Lactuca virosa*. In contrast, very thin soil supported *Thymus polytrichus, Sherardia arvensis, Aphanes arvensis, Pilosella officinarum, Arenaria serpyllifolium, Festuca ovina* and a much debated *Potentilla tabernaemontani* (the find of the day) growing with *Potentilla reptans*.

A sudden shower curtailed further effort and recording was resumed in the precincts of the abbey. When the YNU visited this site in 1898 it was considered virgin territory, but none of these earlier records are available. The Union visited again in 1969, the same year that C.M. Rob and J.M. Holloway produced a botanical species list for the then owner. For many years this list of 162 species was available on site. In 1996, Dick and Marjorie Roberts updated the records and we could add very little to it. Don Grant added *Rubus eboracensis, R. dasyphyllus* and *R. coryfolia* agg. Other than that, we refound *Rubus caesius* and *Festuca gigantea* from 1969 and added only *Polygonum arenastrum* before rain drove us willingly to the tea room.

BRYOLOGY (J.M. Blackburn)

Most of the park was improved grassland, virtually devoid of bryophytes, except on sloping ground, where *Atrichum undulatum, Tortula acaulon* var. *acaulon* and *Weissia controversa* var. *controversa* were found on bare soil. The boundary walls supported *Bryum capillare,*

Grimmia pulvinata, Homalothecium sericeum and *Orthotrichum anomalum* and a horse trough provided *Cratoneuron filicinum, Rhynchostegium riparioides* and *Conocephalum conicum*. Calcareous grassland near one of the fishing lakes had *Homalothecium lutescens*, whilst *Didymodon sinuosus* and *Rhynchostegium murale* were seen on a limestone wall in the same place. Trees in the park were largely unrewarding, with *Dicranoweisia cirrata* and *Orthotrichum diaphanum* the only species recorded.

The abbey ruins were quite rewarding. An earlier visit 12 years earlier resulted in a list of 21 species. Most of these were refound and a further eight species seen, which says more about improved recording skills than an increase in the species present. The grassed areas had *Rhytidiadelphus squarrosus* and *Scleropodium purum,* whilst *Anomodon viticulosus, Plagiochila porelloides* and *Porella platyphylla* were growing on the limestone walls. The wall bases had some *Mnium stellare*. Some sandstone was present in the ruins and *Grimmia trichophylla* was recorded on this substrate.

A total of 43 species was recorded on the day.

LICHENOLOGY (A. Henderson)

Two Leeds BSc students, Lucy Godfrey and Jude Lane, engaged on theses involving lichens, attended the meeting. As Lucy's thesis concerns Austrian alpine moraines, a practice project was devised for the day measuring the size and assessing the age of thalli of *Lecanora campestris, Lecania erysibe* and *Opegrapha calcarea* on the abbey walls and of *Ochrolechia parella* on nearby roadside walls. Results gave rise at the reports session to an enjoyable discussion as to why the diameters measured on the abbey walls nowhere exceeded 13 cm, while *O. parella* on the walls outside the abbey achieved diameters up to 21 cm. The date of the abbey's dissolution, the effect of past air pollution, competition between competing thalli and differing growth rates were among factors considered but, unsurprisingly, no definite conclusion was reached from the results of such a short project, which was anyway curtailed by heavy rain in the afternoon.

An earlier general survey before the later downpour revealed a magnificent colony of *Peltigera lactucifolia* mingled with *Leptogium gelatinosum*, draping the stepped ruins of a lower inner wall. *Opegrapha calcarea* with its deep black lirelline fruits heaped over one another was of the striking form at one time distinguished as *O. chevallieri*. Most notable among the ruins' often total mosaic cover were *Bilimbia sabuletorum, Collema auriforme, C. tenax* v. *ceranoides, C. fuscovirens, Lepraria membranacea, Melanelia fuliginosa* ssp. *fuluginosa, Tephromela atra* and the frequent *Xanthorion* presence. The lichen amelioration in process on the trees of the area is evidenced most noticeably by young freshly colonising thalli of *Parmelia tiliacea* on old *Acer pseudoplatanus*. All in all, an intriguing day.

HORNSEA MERE (VC61) 7 July 2007 (TA/174463)

INTRODUCTION (Sarah Priest)

The excursion was held at the Wassand end of the Mere by kind permission of Mr and Mrs Russell. 22 members representing 26 affiliated societies gathered in glorious sunshine; this was very welcome weather after what had been a particularly wet June. One consequence of the recent high rainfall was that the water level in the Mere was exceptionally high, higher than locals could remember, restricting access to some of the marginal areas. Janetta Lambert provided copies of the report of the last Excursion to the Mere in 1962, which by an extraordinary coincidence was also on 7 July! The tea and meeting were held in the delightful surroundings of the Orangery in the walled garden at Wassand Hall. The walk from the car park to the garden was notable for the presence of a spotted flycatcher and dozens of swallows and house martins in the outbuildings. Other memorable sightings were of several grass snakes, but the undoubted highlight of the day was the discovery of the rare freshwater snail *Segmentina nitida* which was thought to be extinct in Yorkshire, the nearest colonies being in East Anglia.

MAMMALS, REPTILES AND AMPHIBIANS (Janetta Lambert)
Undoubtedly the most exciting vertebrate record of the day was that of a grass snake specimen which must have been 45-60 cm long when alive, and had been run over on the driveway to the walled garden of Wassand Hall. Two live specimens were also seen in different parts of the estate. No fish were recorded, but frogs, toads and unspecified newts were seen with, perhaps, toads being noticed most frequently.

Rabbits were not numerous, possibly due to the exceptionally wet conditions. Brown Hare, recorded on the Excursion in 1962, was not seen on this occasion. Mole hills were on the higher ground, Grey Squirrel was seen and there were deer slots by a small stream near Wassand Hall.

ORNITHOLOGY (Sarah Priest)
The first sighting of the day was a hobby, over the outbuildings of the Hall, together with good numbers of nesting swallows and house martins. A walk around the Hall gardens and adjacent field produced blackcap and chiff-chaff, together with goldfinch, greenfinch, chaffinch, song thrush and goldcrest. Waterbirds included moorhen, coot, a great-crested grebe with young, Canada goose, greylag, mute swan and cormorant. The spotted flycatcher, which perched on the 'Teas' sign was a delightful addition. A visit to the eastern end of the Mere added tufted duck, a pair of ruddy ducks, a distant sparrowhawk, cuckoo, gadwall, shoveler, stock doves and grey heron. An adult little gull was, perhaps, the bird of the day. Altogether 44 species were recorded.

CONCHOLOGY (Adrian Norris & David Lindley)
A total of 50 species was found in four adjacent 1 km squares, bringing the total recorded from the Mere and its environs to 75. Unfortunately there is no molluscan report published from the YNU meeting held in 1962, but a visit to the area on the 18 May 1969 recorded 54 species. 12 species found in 1969 were not refound on this occasion, but we added a further 10 species to the 1969 list. A number of species recorded from marshy pools within Low Wood on previous visits, such as *Aplexa hypnorum* and *Anisus leucostoma* and one of the Hornsea Mere specialities *Gyraulus laevis*, were not refound on this occasion. Perhaps two of the most interesting additions were *Boettgerilla pallens* and *Limacus maculatus*, species that were unknown in Britain in 1969.

The highlight of the day was the discovery of a colony of the rare freshwater planorbid, *Segmentina nitida*. This snail was recorded from Hornsea Mere as early as 6 June 1881 by William Denison Roebuck but, as far as we can establish, it has never been recorded subsequently. Elsewhere in Yorkshire it was recorded from Askham Bog and Dringhouses Bog near York and a single specimen is recorded from Pontefract. Once widespread, this snail has suffered a dramatic decrease in its known distribution. In "A Yorkshire Red Data Book for land and freshwater mollusca" (*Naturalist* **123**: 113-117, 1988), it was said to be considered extinct in the county. The nearest other known colonies are now in East Anglia.

LEPIDOPTERA (Terry Crawford)
Despite the weather conditions being marginal for butterflies, good numbers of Meadow Brown and Ringlet were seen throughout the area, together with a few second-generation Whites and Small Tortoiseshell, particularly on the edges of arable crops; also reported were singletons of Brimstone, Red Admiral, Comma and Speckled Wood butterflies and Small Magpie (Pyralidae), Barred Straw, Cinnabar (a larva), Large Yellow Underwing and Straw Dot moths.

COLEOPTERA (M.L. Denton)
The fine weather, the first for several weeks, gave some indication that the coleopterists might be in for a rewarding day. Even before we left the meeting place, Bill Dolling had found the locally distributed longhorn *Leiopus nebulosus*. Another longhorn, the common *Grammoptera ruficornis* was frequently encountered throughout the area. The cow dung in

a number of the pastures was relatively unrewarding, raising the question as to whether this was a consequence of the recent poor weather or the use of internal parasite-controlling drugs such as Ivermectin. There were few Aleocharinae present, although a male and female *Aleochara intricata* was only the tenth Yorkshire locality for this widely distributed species. Over the last few years there has been much talk about unseasonable records of invertebrates (particularly moths and butterflies), but one beetle species, *Rhagonycha fulva,* has always been true to form by appearing during the first week of July; the species was found commonly throughout the area on hogweed.

In Decoy Plantation a couple of discarded hay bales produced a good number of beetle species: the rove beetles *Rugilus rufipes, Trichiusa immigrata* (first recorded as British in Kent during 1992, now widely distributed in the British Isles), *Ocypus brunnipes* and *Cypha pulicarius* (a nationally Notable species with Yorkshire records from eight localities, including Low Wood, Hornsea Mere, in 2003). Several common water beetles were present in the pond near the Hall, among which was a single specimen of the locally distributed Screech Beetle *Hygrobia hermanni* – this species is widely distributed at lower elevations in Yorkshire but is nowhere as common as formerly. At one time large numbers were sold in the streets of London; the squeaking noise making it a novelty! The Water Figwort *Scrophularia auriculata* along the pond edge harboured the Figwort Beetle *Cionus scrophulariae*. The find of the day, however, was a single Lesser Stag Beetle *Dorcus parallelipipedus,* found by Bob Marsh on a tree stump in Decoy Plantation. The species is widely, but thinly, distributed at lower elevations in the south and east of the county.

Non-removal of tree stumps and decaying trees, obviously the policy on the estate, will ensure the continued presence of species such as *Dorcus* and other saproxylic species which are dependant on this habitat. An annotated list of the 170 species recorded has been housed with the owner.

PLANT GALLS (Tom Higginbottom)

The site in the grounds of Wassand Hall and the western end of Hornsea Mere looked to have potential for plant galls. 24 galls were discovered during our searches. One of the most interesting was the often overlooked gall on the leaves of white clover, *Trifolium repens*. The midge *Dasineura trifolii* folds a leaflet upwards along the midrib to form a pod-shape; it contains white larvae which later become orange in colour. Another interesting discovery was the distinctive leaf-roll on redshank *Persicaria maculosa* caused by another midge *Dasineura bistortae*. One of the major surprises for cecidologists was how few galls were discovered. None of the common galls were discovered on alder, there were also no records of galls on willow and even the common galls on meadowsweet, the white pimples caused by *Dasineura ulmaria* and the small disc-shaped swellings caused by *Dasineura pustulans,* were not easy to find, even though the plant was very common. An interesting day leaving cause for reflection as to why there were so few galls.

BOTANY (Richard Middleton)

Since one of the main goals had been to establish how many of the plants mentioned in the report of the previous YNU visit 45 years ago would still be present, it was with some dismay that the botanists realised that recent heavy rains had raised the level of the Mere to such an extent that many of the more attractive sites near the water side were flooded and would be inaccessible. Spirits were lifted after traversing areas of bland improved grassland to encounter a marshy area dominated by *Glyceria maxima* and *Carex riparia* along with *Angelica sylvestris, Valeriana officinalis, Thalictrum flavum* and *Lychnis flos-cuculi*, all species noted on the last visit. After a valiant attempt to reach the boat-house, the party was defeated by the alarming water levels in Decoy Plantation and retreated to drier ground. While working towards the mereside, a fine piece of grassland was encountered containing *Hordeum secalinum* and *Trisetum flavescens* accompanied by many herbs, including *Conopodium majus, Stellaria graminea* and *Galium verum*. Wading through the lower parts of this field also revealed abundant *Carex disticha*. The mereside was reached

near to the gravelly mounds noted in the 1962 report but heavy grazing had reduced their botanical interest and *Ononis spinosa*, known to be present until very recently, could not be re-found. Fortunately this disappointment was soon compensated for by the discovery of the scarce *Potamogeton pusillus*, mixed with *Ceratophyllum demersum*, in the shallow waters at the edge of the lake.

The fields east of Wassand Hall yielded an interesting crop of arable weeds including *Lamium hybridum*, *Viola arvensis* and *Veronica persica*, all noted in the earlier visit, but some of the scarcer taxa were replaced by *Anagallis arvensis* and a sward of willowherbs including *Epilobium ciliatum* and *E. obscurum*. The immediate grounds of Wassand Hall provided some botanical interest, particularly around and in the new pond where the alien Parrot's-feather *Myriophyllum aquaticum* was thriving. The walled garden also provided records for a few plants not noted earlier, including *Euphorbia helioscopia* and *E. peplus* in the vegetable beds and *Cymbalaria muralis* and *Phyllitis scolopendrium* on the brickwork.

BRYOLOGY (J.M.Blackburn)

The morning was spent in the woodland near the car parking area, where most of the day's records were seen. The damp areas adjacent to the pond produced *Brachythecium plumosum, Calliergonella cuspidata* and a patch of *Dicranella schreberana*. Drier areas of ground were mainly grassed, but small amounts of *Atrichum undulatum, Plagiomnium rostratum* and *P. undulatum* were present. The sycamore trees had cover on the bases, with *Dicranoweisia cirrata* and *Orthotrichum diaphanum* the main interest. An ash tree trunk had a fine patch of the attractive liverwort *Frullania dilatata*. A large field being grazed by cattle was unrewarding. An area of willows in the field, and most other willows seen were surprisingly devoid of bryophyte cover. However, *Metzgeria fruticulosa* was found on elders. A set-aside field added *Eurhynchium hians* to the list. The visit ended with an inspection of the walled garden. Very quickly seen was *Tortula marginata*, a calcicolous moss growing on mortar on the old brick walls, with *Leptobryum pyriforme* also in some quantity. A rather modest total of 27 species was recorded on the day.

LICHENOLOGY (A. Henderson)

Attention to the range of habitats offered by Wassand Hall, trees, lignum (posts and gates), walls (stone, brick and concrete) and pathways produced an interesting list. Highlights of the day were the walled garden and its fountain, a gravelled farmyard, some older cottage walls and some older *Acer*. Both surrounding and inner walls of the walled garden had a dense lichen mosaic, dominated by *Tephromela atra* and *Lecanora albescens*; the stonework of the fountain had, along with *Porpidia tuberculosa, P. crustulata* and *Lecanora polytropa*, two grey *Rhizocarpon* species, *R. petraeum and R. reductum*. *Acer* along the approach to the Hall supported *Evernia prunastri* with a little *Ramalina farinacea* and occasional *Parmotrema perlatum*. On the boles, but only infrequently, *Opegrapha calcarea* was noted. A very limited gelatinous flora of *Collema tenax* v. *tenax* and *C. crispum*, occurred on the gravelled area of an old farmyard and rarely on the garden paths. Older walls had occasional thalli of *Diploicia canescens*, and an old wooden gateway to the woodland added *Lecanora saligna* and *Micarea denigrata* to the day's total of 60 species.

EAST ARNCLIFFE WOOD, GLAISDALE (VC62) 21 July 2007 (NZ/784055)

INTRODUCTION (J.M. Blackburn)

A party of eight from eight affiliated societies braved the poor weather which has dogged the summer to survey East and West Arncliffe Woods. Conditions underfoot were bad and this deterred the group from straying far from the main path through East Arncliffe Wood. However, the weather improved and the afternoon was warm and sunny. These woods have been well studied for flowering plants and over 240 species have been recorded. They are particularly rich in ferns, with 23 species recorded and seven hybrids. The mosses too have been well researched, with 132 species recorded, making this the richest wood in North

East Yorkshire for bryophytes. It had been hoped that other floral and faunal elements would be studied on the day, but the preferential interests of those attending resulted in a concentration on flowering plants with snails recorded by one late attendee during the afternoon.

During the day several frogs were seen on the riverbank, three molehills noted and roe deer slots observed. Holes seen indicated the likely presence of Wood Mice. No Rabbits or Grey Squirrels were seen, though the southern end of the wood was not explored. Fungi were much in evidence, including *Russula* spp. and *Phallus impudicus*. A large carabid beetle with violet front parts was probably *Carabus problematicus*.

Permission had been obtained to enter West Arncliffe Wood, but time was against us and only snail records were collected from here. Several members left in mid-afternoon. As a result, the proposed indoor meeting was abandoned and a short *al fresco* meeting took place instead. It was generally agreed that an examination of other flora and fauna in East Arncliffe Wood, possibly through sectional meetings, could be very profitable. Letters of thanks will be sent to the owners.

ORNITHOLOGY (J.M. Blackburn)
A heron was spotted above the river from the car park at the start of the meeting. Chiffchaffs were soon heard in the wood. Other sightings during the day were Blackbird, Robin, Wood Pigeon and several Wrens. The river was in spate and the Dippers, normally seen upstream of the road bridge, were not in evidence.

CONCHOLOGY (A. A. & M. Wardhaugh)
Due to the particularly heavy rain of some recent days and on the morning of the meeting, recording was limited to 1.30 pm onwards. Effort was concentrated on West Arnecliff Wood as normally this has no public access. Here, 23 species were recorded in total from three 1 km squares (8 from NZ/7704, 14 from NZ/7804 and 12 from NZ/7805). In the shorter time spent in East Arnecliff Wood, 15 species were recorded (13 from NZ/7804 and 4 from NZ/7805). Overall, 26 species were found either on site or in leaf litter samples collected for later examination.

The two most significant finds were the slug *Malacolimax tenellus* and the snail *Spermodea lamellata*. A single specimen of *M. tenellus* was found on site in West Arnecliff Wood, in beech litter just to the west of a dry stone wall separating the two woods (the nearest open area at NZ/78354.05032, alt. c. 135m). Restricted to ancient semi-natural woodland, both deciduous and coniferous, this species has been recorded previously from only three other sites in VC 62, one of which is East Arnecliff Wood (NZ/792046B, Colville & J. Nelson, 28.9.1992). *M. tenellus* feeds on fungi and it is interesting to note that a large group of fruiting bodies of *Cantharellus cibarius* was present very close by. Four live specimens of *S. lamellata* were recovered from a leaf litter sample from West Arnecliff Wood. The litter was almost exclusively Greater Woodrush *Luzula silvatica*, collected from beside a small stream where it crosses a footpath (NZ/780044) and surrounded by woodland that has been much replanted with conifers. This is likely to be a relict population as *S. lamellata* is indicative of ancient semi-natural woodland and will not survive here should the woodrush eventually be shaded out by conifers. Hopefully it may occur elsewhere in the wood in other more favourable areas.

Other species of interest recorded included the snails *Clausilia bidentata* and *Cochlodina laminata*, found in both woods. *Columella aspera* and *Columella edentula* were both present in the woodrush litter from West Arnecliff Wood. The slug *Arion silvaticus* was found in East Arnecliff Wood.

LEPIDOPTERA (P. G. Tannett)
Lepidoptera were very sparse on the day. Those seen were *Herminia tarsicrinalis*, *Idaea biselata* and almost certainly *Perizoma taeniata*, but this somewhat rare species awaits confirmation.

FLOWERING PLANTS (J.M. Blackburn)

The grasses in the wood were soon causing some head-scratching, with 13 species finally identified, including the attractive *Milium effusum*. A single plant of *Festuca altissima*, known to occur in the wood was, however, not refound. Clumps of *Ceratocapnos claviculata* were observed and several *Epipactis helleborine* plants were spotted by one keen-eyed observer. The tree cover was mixed, with *Acer pseudoplatanus, Betula pendula, Corylus avellana, Fagus sylvatica, Fraxinus excelsior, Quercus robur* and *Sambucus nigra* all present.

The plant which brought out the cameras was *Hymenophyllum tunbridgense*, found in quantity in a deep wide cleft in the rocks. This is believed to be one of only six colonies of the plant in Eastern Britain. *Carex remota* was frequent in the wood and several clumps of *C. pendula* were seen by the old fish ponds. Both *Ribes idaeus* and *R. rubrum* were recorded. Had conditions been better, an examination of the rocky slopes would have been profitable. Some mildly basic ground here has *Polystichum setiferum* and *Phyllitis scolopendrium*; *Gymnocarpium dryopteris* and *Phegopteris connectilis* are also present in this area.

LICHENS (J. Lambert)

Several specimens collected during the day, subsequently determined by A. Henderson, included *Cladonia squamosa, Hypogymnia physodes* and *Cliostomum griffithii*.

POTTERIC CARR (VC63) 4 August 2007 (SE/589007)

INTRODUCTION (R. Marsh)

On a day of fine weather, 17 members gathered at the YWT's prestigious new reception facilities at the Potteric Carr Nature Reserve, and progressed to the new Field Centre. From there they dispersed to examine many different areas of this large and varied site, with its complex of woodland, reed beds, marshes and disused railway embankments. Mr John Hancox and Mr Derek Bateson gave an excellent presentation about the reserve with a brief history and introduction to the site, and discussed the Reserve's latest project, the creation of new water bodies and reedbeds in a large area of what was previously arable land.

After the field meeting, the indoor meeting was held in the Field Centre, and was attended by 15 members. Reports were given and thanks expressed to the YWT for their hospitality, with special thanks to Messrs Bateson and Hancox, and to Mrs Hancox for dealing with refreshments.

CONCHOLOGY (Terry Crawford)

Only 18 species of terrestrial mollusc were found, partly because there was only one recorder, but also because much of the area visited seemed rather unsuitable with birch scrub and/or a soil derived from cinders. Nevertheless, five species were added to the list held by the YNU Recorder: *Lauria cylindracea*, *Oxychilus draparnaudi*, *Tandonia budapestensis*, *Trochulus hispidus* and *T. striolatus*. No records are noteworthy, but there are some interesting features. A synanthropic element, possibly introduced since the nature reserve was created, was shown by the presence of *T. budapestensis* near the Field Centre, and especially *O. draparnaudi* near the main entrance and car park. *Arion ater* agg. was found at only two sites, separated by 0.5 km, one of which presented several individuals; all of these slugs were of an attractive and unusually uniform light-chestnut colour. The most regularly encountered snail was *Cepaea nemoralis* and it showed a rich diversity of shell colours and banding patterns, particularly in Childers Wood.

LEPIDOPTERA (Terry Crawford)

The weather, fine but intermittently cloudy, fluctuated from quite good to marginal for butterflies. Green-veined White were common across the reserve, with plenty of Peacock

during the warmer spells. Speckled Wood, many looking very fresh, were active in the wooded areas, as were Gatekeeper in the scrubby and open habitats. There was much butterfly activity on the banks of the Mother Drain, near Rossington Bank, where *Senecio jacobae* was an attractive nectar source. Other species that were rare or singletons were Small Skipper, Brimstone, Large White, Common Blue, Red Admiral, Meadow Brown, and a worn-out Ringlet. No moths were reported.

ODONATA, HYMENOPTERA AND DIPTERA (A. Grayson)

Insects were abundant throughout the areas surveyed by the writer, i.e. west and south of the Field Centre, and particularly along the banks surrounding Division Drain. Of the Odonata, *Sympetrum striolatum* males were particularly abundant along the many paths and other open areas; also recorded were *Ischnura elegans, Lestes sponsa, Aeshna grandis, Anax imperator* and *Sympetrum sanguineum*. The only bumblebees recorded were *Bombus lapidarius*, *B. lucorum* and *B. pascuorum*. Female mosquitoes and horseflies found the hot and sunny weather favourable to their blood-sucking activities. *Chrysops relictus* and *Ochlerotatus annulipes* were abundant and virulent throughout the day, together with much smaller numbers of *Chrysops caecutiens*, *Haematopota pluvialis* and *Ochlerotatus punctor*. The local conopid *Physocephala rufipes* was present in small numbers on a grassy bank near Division Drain. Other Diptera included *Chrysopilus cristatus, Machimus atricapillus, Empis livida, Platycheirus albimanus, Chrysotoxum bicinctum, Eristalinus sepulchralis, Eristalis intricarius, E. pertinax* and *Helophilus pendulus*.

John Blackburn noted *Coenagrion puella, Enallagma cyathigerum* and *Ischnura elegans* flying through the vegetation, *Aeshna cyanea* patrolling a stretch along one of the main tracks, and a single *Libellula quadrimaculata* being harassed by the larger dragonflies. Members also recorded several *Calopteryx splendens,* and *Aeshna juncea* was caught on camera in the new part of the reserve.

COLEOPTERA (R. Marsh)

The day generally proved to be a poor one for coleoptera, with a couple of exceptions. *Oxystoma cerdo*, one of the '*Apion*' weevils was found on its host plant *Vicia cracca* near the Field Centre. This was only the third county record after its initial discovery at Magna in 2006 (another VC63 meeting). The larvae feed in the seeds (whilst still within the pods) of the host plant. Also recorded was *Tytthaspis 16-punctata* (a sixteen-spot ladybird), from the Hawthorn Field area of the Reserve. Were the accuracy of the YNU records to be relied upon, this would be the first discovery in the county since 1877. However, there is a mystery entry for SK59 dated November 2005 on the NBN Gateway which will have to be investigated by the writer. SK59 includes the Potteric Carr area. In any event, the species is very rarely recorded in Yorkshire. The beetle is associated mainly with marshy habitats but can occur in drier, more heathy places. Nationally there seems to be a very abrupt cut-off in its distribution along a line from the Severn to the Wash, with very few records to the north and west of this line.

The edges of the water bodies within the newly created Huxter Well Marsh area of the Reserve should, given time, prove to be productive of wet marginal habitats and their associated organisms, as hygrophilous beetle species such as *Elaphrus riparius, Bembidion genei* and *B. lunulatum, Agonum marginatum* and *Stenus guttula* were much in evidence.

Survey results for the day fell well below expectations with 35 or so species, in some part no doubt as a result of the appalling June/early July weather having suppressed beetle populations.

PLANT GALLS (Tom Higginbottom)

Over 60 different plant galls were recorded during the visit, 18 of which were recorded on oak, including the less common bud galls of the agamic generation of *Andricus callidoma* and *A. solitarius*. Other plants are less frequent hosts for gall wasps, but the less common gall wasp *Liposthenes glechomatis* had caused hairy, spherical swellings on the leaves of

ground ivy. The most unusual discovery on the day was on common reed growing beside the Piper Marsh hide. The mite *Steneotarsomenus phragmitidis* had caused the young leaves to become wrinkled, folded and twisted, in an almost ladder-like shape. There do not appear to be any recent records of this gall causer in Yorkshire. In the newer part of the reserve a distinctive swelling, observed on the stem of creeping thistle, was caused by the tephritid fly *Urophora cardui*. The first Yorkshire record of this gall was in 2006 at a site near Fishlake, although it is common in the south. A swelling was also discovered on the stem of rosebay willowherb which was caused by the micro-moth *Mompha sturnipennella*. It is not surprising that, in recent years, Potteric Carr has proved to be one of the best sites in Yorkshire for the study of plant galls.

BRYOLOGY (J.M. Blackburn)
It was soon evident that the species list for the reserve would not be extensive. The willows in the carr areas were largely devoid of cover. The main trees in the drier areas were the acid-barked birch, along with oak and sycamore, none of which were productive. *Dicranella staphylina* and *Ditrichum cylindricum* were soon found on gravelly soil, along with other common species. In the wooded areas, *Atrichum undulatum* and *Plagiomnium undulatum* were found, and *Calliergonella cuspidata* was common, particularly on damper ground. Open peaty areas had much of the invasive *Campylopus introflexus*. A modest 22 species were recorded.

LICHENOLOGY (A. Henderson)
Those parts of the Carr explored did not have a very diverse flora, but possibly a return visit to explore other areas of the reserve might yield further species. The most pleasing find of the day was several colonies of *Peltigera lactucifolia* intermingled with *Cladonia furcata* along the pathway northwest of the Field Centre. The corticolous flora was nowhere seen to be richly developed, but there are signs of advancing colonisation in some places with a little *Ramalina farinacea* and *Evernia prunastri* not uncommon among a limited *Parmelietum* composed mainly of *Parmelia sulcata* and *Melanelia subaurifera*, with some members of the *Xanthorion*. Shadier trees have only *Lecanora conizaeoides, L. expallens, Placynthiella icmalea* and *Lepraria incana* with occasional bright rusty orange-red coatings of the filamentous alga, *Trentepohlia aurea*, in the deepest shade. *Caloplaca crenulatella*, now proving to be widely distributed, was noted among the calcicolous population of the Field Centre. The day's total was 32 species.

BOOK REVIEWS

The Birds of the Huddersfield Area by **Paul Bray** and **Betty Bray**. Pp. 419, with breeding distribution maps and several drawings. Huddersfield Birdwatchers' Club. 2008. £12.00 softback, from M.Wainman, 2 Bankfield Park Avenue, Taylor Hill, Huddersfield HD4 7QY.

For over 100 years, British ornithological literature has, in addition to county avifaunas, included lists of birds at a more local level and England's greatest county has been at the forefront. The Huddersfield area has been the subject of several accounts of its birdlife, the more important being S.L.Moseley's *Birds of the Huddersfield District* (1915), John Dale's *Status of Birds in the Huddersfield Area 1959-1974* (1975) and Stephen Hey's *Checklist of Birds in Huddersfield 1958 -1993* (1993).

Paul Bray joined the Huddersfield Birdwatchers' Club in 1971 and a passion for his home territory led him, together with his wife Betty, to embark upon this formidable project: the sheer volume of work, the enthusiasm and meticulous application shines through every page. The Club's adopted recording area of the six 10 km squares (SE00, 10, 20, 01, 11 & 21), with an extension to the north into squares bordering the Rivers Ryburn

and Calder (SE02 & 12), includes a large part of the manufacturing districts of West Yorkshire which stretch northwards to Bradford and Leeds and eastwards to Wakefield. Lying at the southern edge of this vast and generally uninspiring conurbation, the Huddersfield district has, however, many good and varied bird habitats which have played host to 261 species, such as the parklands of Bretton and Cannon Hall, several reservoirs, the most ornithologically important being Blackmoorfoot, and the northern part of the Peak District National Park, the border of which is but 8 km from the centre of the town.

The Systematic List (324 pages) includes very clear distribution maps for the 106 breeding species and comprehensive details for the passing migrants, winter visitors and rare birds. There are also lengthy and very detailed chapters on the region's geology and climate, its bird habitats, sources of information, and bird surveys undertaken by the Club. The Introduction includes details of the topography, outlining habitats ranging from the highest point (582 m) of Black Hill in the south-west to the lowest land (30 m) alongside the River Calder in the north-east. Appendices include the classification of breeding birds by habitat and a list of breeding species in order of abundance.

The authors are to be heartily congratulated, as are the members of the Huddersfield Birdwatchers' Club – one of the most active and successful of such clubs in Yorkshire – for their involvement in this publication, thus ensuring its place in the national archive. It is a worthy testimony to the authors' dedication and hard work, and stands as a model for future local avifaunas.

JRM

Scottish Mammals by **Robin Hull**. Pp. 342, including numerous silhouette drawings by **Malcolm Appleby** and 19th century engravings. Birlinn, Edinburgh. 2007. £14.99 softback.

Robin Hull's Scottish Mammals is a splendidly personal and self indulgent wallow through a vast anthology of literary and historical sources ranging from Pliny the Elder and the Venerable Bede, through Mrs Beeton and Beatrix Potter, to Stephan Buczacki and Sir David Attenborough, taking in several hundred other authors on the way.

Essentially this is a chronological survey of Scotland's mammalian fauna from the end of the last ice age to the present day and more particularly of human perceptions, attitudes and interactions with these creatures. The slant and style of the book is perhaps best described by listing the titles of the introductory sections (the first 100 pages); these include Before Christ; The Credulous Ages: First to Sixteenth Century; The Dawn of Science: Seventeenth to Mid-eighteenth century; Enlightenment: Mid-eighteenth to Mid-nineteenth century; The Time of Slaughter: Mid-nineteenth to Mid-twentieth century; The Age of Environmental Threat: Mid-twentieth century onwards.

There is a good, if quirky, bibliography and comprehensive indexes to animals, people and Scottish place names.

Sadly the revelations of the new and inspirational work by many of the towering giants of Scottish terrestrial and marine mammal studies of the past couple of decades are barely hinted at in this book. This is a disappointment, given its title. However, Robin Hull's book is an engrossing, contemplative and literary work of social history. By the author's own admission, the book contains 'all sorts of nonsense', including the folklore and previously believed notions underlying the understandings and misunderstandings which have informed our dysfunctional relationship with the natural world over the centuries.

One constructive outcome of this book has been to highlight the need for a lavishly illustrated companion volume featuring the modern generation of academic research and new discoveries on the Mammals of Scotland.

CAH

Sedges of the British Isles by **A.C.Jermy, D.A.Simpson, M.J.Y.Foley** and **M.S.Porter**. Pp ix + 554. Botanical Society of the British Isles, London. 3rd edition, 2008. £15.50 paperback.

This new edition of *Sedges of the British Isles* in the BSBI Handbook series covers a broader range of taxa than its predecessors in that, as well as all the British species of the genus *Carex*, it covers hybrid sedges and all other members of the *Cyperaceae* (more than tripling the weight in the rucksack!).

Following the Preface and due acknowledgement of the many people who have helped with the production of the book, the introduction enumerates changes in taxonomic nomenclature; this is followed by a very useful chapter dealing with the structure of the plants in the family *Cyperaceae*. The classification of species is explained, the ecology and habitat preferences are described and then there is a guide to the recognition of hybrids.

Keys to the identification of species are followed by a description of each one, with useful drawings of the parts of the plant and a map of its distribution. A brief description of each of the hybrid sedges is accompanied by a table comparing it with both of its parents. The index is preceded by a glossary and a lengthy bibliography.

This work gives a very useful update to the sedges along with a similar treatment of the other members of the *Cyperaceae*.

PPA

The Emerald Planet. How plants changed Earth's history by **David Beerling**. Pp. xvi + 288 (incl. 13 figs), plus 8 pp b/w plates. Oxford University Press. 2007. £14.99 hardback.

Let's hear it for the plants! Books like this should be applauded since they raise the profile of our green world which is fast declining due to mismanagement. The author, Professor of Paleoclimatology at the University of Sheffield, does just this by drawing attention to the vital role of plants in moulding our planet since their arrival 470 years ago, particularly its climate by counteracting the excessive increases in carbon dioxide levels brought about by the effects of burgeoning numbers of animals (through the utilisation of this gas and the ability to recycle oxygen). This is a gripping story and a must for anyone with an interest in science or indeed our planet, since the destruction of our forests and other agricultural practices have exacerbated current climatic problems resulting from increases in carbon dioxide emissions from man-made sources. A taste of what is to be found within the pages of this book can be gauged from some of the chapter headings: leaves, genes and greenhouse gases; global warming ushers in the dinosaur era; the flourishing forests of Antarctica; nature's green revolution – the whole supported by 60 pages of detailed notes and published sources, illustrations and a useful index. Such material sheds light on current environmental problems and provides clues as to how our world is likely to change, ecologically and climatically, without positive action. Strongly recommended, particularly for students.

MRDS

The Liverworts, Mosses and Ferns of Europe by **W. Frey**, **J.-P. Frahm**, **E. Fischer** and **W. Lobin**. English edition edited by **T. L. Blockeel**. Pp. xvi + 512, incl. 166 figs. Harley Books, Colchester. 2006. £45.00 hardback.

Although described as a field guide, many of the 2000 European species keyed out and described therein will require detailed indoor investigation, more particularly with the aid of a microscope. The wealth of information is almost encyclopaedic for such a large group of plants and an area that stretches from Iceland to the Russian Urals; also included are the Macaronesian islands, and in the case of the ferns, Georgia, Caucasus, Turkey and Cyprus. Undoubtedly, due to its coverage, this book will be a must for cryptogamic botanists on their travels due to a substantial increase in our knowledge of the distribution of these

ecologically interesting plants. As well as detailed keys, complemented by illustrations (166 figures comprising 1938 detailed line drawings), there is a glossary (11 pages), references and further reading (14 pages, with publications containing lists of rare and Red Data Book species highlighted), and index with synonyms. The authors are to be congratulated on their contributions, and despite the slight differences in the presentation of the liverwort, moss and fern sections due to different authorships, Tom Blockeel, Recorder for the Bryological Section of the YNU, is deserving of the highest praise for his editorship of a most useful volume for both amateur and professional botanists.

MRDS

Wild Costa Rica by **Adrian Hepworth**. Pp. 176, with numerous colour plates. New Holland. 2008. £29.99 hardback.

The author lived in Costa Rica for 14 years and leads photographic expeditions there. One might be excused for thinking that this large format book is just another glossy vehicle for his photographs which, together with others from various colleagues, adorn every page, but it is much more than that. Most of the pictures are stunning, some covering the whole page, and depict representative species of most of the main orders as well as the impressive scenery. The book is divided into sections, each with full, detailed and informative text covering habitats and flora, the wildlife (including invertebrates, amphibians, reptiles, birds and mammals), volcanoes, national parks and reserves, conservation and tourism.

With an area of 32,000 square miles (51,000 km^2), less than half the size of England, Costa Rica has a staggering variety of wildlife (some of it endemic); with 240 species of mammals, 860 birds, 221 reptiles, 174 amphibians, 10,000 plants and 370,000 invertebrates, it thus has a higher density of animal and plant species than any other country in the world.

It owes much of this richness to its volcanic origins: the Central American isthmus which joins the South and North American continents was thrown up three million years ago, allowing migration of life forms in both directions. The resulting central mountain range created two very different climates, namely a very wet Caribbean slope and a hot dry Pacific slope, each with its share of differing flora and fauna. Around 25% of the country is protected within national parks and private reserves, although there is still deforestation and a need for further protection.

Anyone who has visited, or has an interest in, this beautiful and accessible country should certainly buy this book. Having personally explored its many and varied habitats on several occasions, I still found much to learn and enjoy within its pages.

JRM

Charles Darwin. **On the Origin of Species** edited by **David Quammen**. The Illustrated Edition. Pp. xvi + 544, incl. numerous coloured & b/w illus. Sterling Publishing, New York & London. 2008. £20.00 hardback.

Due to its lavish production, this version of one of the most influential books ever written will undoubtedly extend its readership to those who would not normally be expected to read it. Generations of biology students have read this work as a matter of course, but a wider audience may have been daunted by such a task in the past. The editor of this version is to be congratulated for making this classic work more accessible; every effort has been made to supplement, and indeed complement, the original work by the juxtaposition of pertinent texts (mainly from Darwin's other publications, particularly *The Voyage of the Beagle*) and more than 350 illustrations from a very wide range of sources. In doing so, a clear picture of Darwin is portrayed and the subsequent debate aroused by the book is traced. This version includes 'An historical sketch of the progress of opinion on the origin of species' used as the foreword to the third edition of the *Origin* published in 1861. An introduction (8pp), useful glossary of the principal scientific terms used (7pp) and detailed

index (9pp) are also provided. The editor and publishers have created a fitting tribute to celebrate the 150th anniversary of the first publication of this remarkable book.

MRDS

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Printed in Great Britain by Titus Wilson & Son, Kendal — ISSN 0028-0771